MATERIAL FOCUS

Research

Assessing feasibility of a UK e-waste matching system

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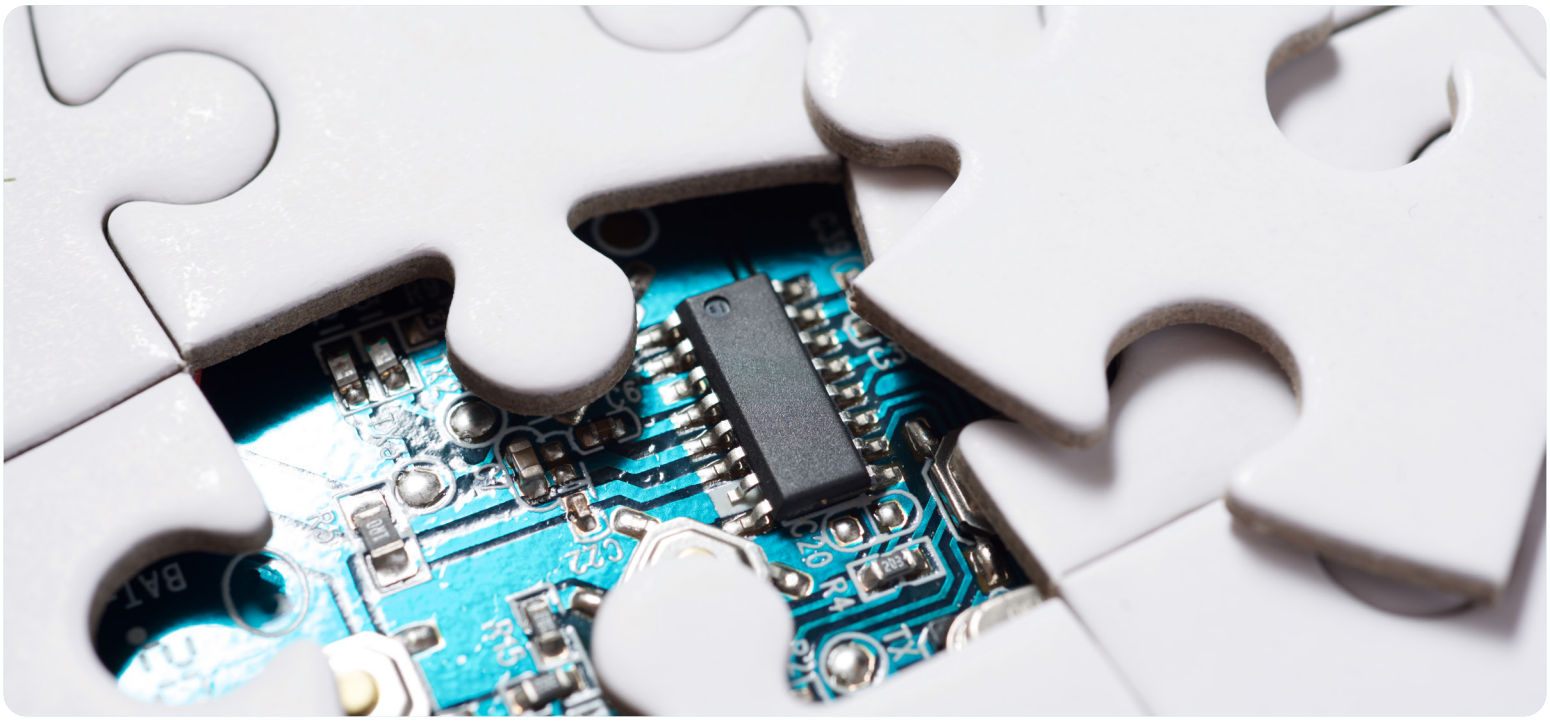

A report by

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A UK WEEE Matching System: a feasibility study of options

Prepared for Material Focus

By Oakdene Hollins

With the support of the WEEE Forum

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Report on A UK WEEE Matching System: a feasibility study of options

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Value-driven consulting

Science-led research

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List of Abbreviations

AATF	Approved Authorised Treatment Facility
BAT	Waste batteries and accumulators (Denmark)
B2B/B2C	Business-to-business/Business-to-consumer
CdC RAEE	Clearing House (Italy)
CSR	Corporate Social Responsibility
CTA	Consumer Technology Association (Illinois)
DCF	Designated collection facility (undertakes the separate collection of WEEE prior to treatment)
DPA	Danish Producer Responsibility
DTS	Distributor Take-back Scheme (UK)
EAR	Stiftung elektro-altgeräte register (Germany)
EEE	Electrical and Electronic Equipment
ElektroG	Electrical and Electronic Equipment Act (Germany)
EPA	Environmental Protection Agency
EPR	Extended Producer Responsibility
ERRO	Electronics recycling representatives organisation
EU	European Union
HWRC	Household Waste and Recycling Centre
ICER	Industry Council for Electronic Equipment Recycling
KPI	Key Performance Indicator
LA	Local Authority (Equivalent to Municipality)
LARAC	Local Authority Recycling Advisory Committee
LDA	Large Domestic Appliances
MCP	Municipal Collection Point
NAWDO	National Association of Waste Disposal Officers
örE	Public waste disposal authorities (Germany)
PBS	PCS Balancing System
PCS	Producer Compliance Scheme
POM	Placed on the Market (the quantities of EEE available in each EU Member State)
PRO	Producer Responsibility Organisation (equivalent to PCS)
RTB	RTB WEEE Compliance, a PCS operated by ERP UK Ltd for a select group of retailers with WEEE obligation
SMW	Small Mixed WEEE
UBA	Federal Environment Agency (Germany)
WCA	Waste Collection Authority
WDA	Waste Disposal Authority
WDF	WasteDataFlow
WEEE	Waste Electrical and Electronic Equipment
WMC	Waste management contractor
WSF	WEEE Schemes Forum
All-actors approach	A policy model which includes all natural and legal persons that have legal responsibilities in WEEE management, are handling WEEE (collection, logistics, preparation for re-use, refurbishment, treatment of WEEE), monitor WEEE, legislate and enforce WEEE legislation. All actors are obligated to abide by the WEEE Directive (such as on compliance, monitoring, and reporting), and work towards the common goal of responsible WEEE operations and transparent monitoring. This is the definition as explained in the FAQ of the recast of the WEEE Directive in point 7.1.
Mandatory Handover[1]	All WEEE management is carried out exclusively by permitted WEEE collectors and recyclers that are contracted with PCSs, and all WEEE that is collected by actors other than permitted actors is to be handed over to the PCSs or permitted ones.

[1] WEEE FORUM, 'An Enhanced Definition of EPR and the Role of All Actors.', November 2020.

1 Executive summary

The purpose of this study is to research how matching has worked in other territories, and to develop an up-to-date evidence base on whether and how matching could benefit the UK system and be practically implemented. The findings will support the upcoming consultation for the UK Waste Electrical and Electronic Equipment (WEEE) Regulations.

Matching (sometimes also known as 'allocation') refers to the requirement for producer compliance schemes (PCSs) to collect WEEE from various sources at a level equivalent to their producer members' combined market share. It is an alternative to the current contract-based system in the UK, and would mean that PCSs would no longer need to competitively tender for access to some or all designated collection facilities (DCFs).

With many PCSs operating in the UK, matching would mean that financial and human resources previously expended on competing for access to WEEE could be freed up and redirected towards more productive and progressive activities to improve the performance of the WEEE system. However, this would need to be balanced by the financial and human resource cost required to set up and operate a UK-wide matching system.

Matching would also ensure that all PCSs have access to their market share of collected WEEE from across the UK. This would remove economic distortions that arise from selective collections due to the significant differences in the nature and costs of DCFs and WEEE streams.

In the UK context, matching would also require all PCSs engage in collection activities, and reduce the use of evidence purchases.[2] With appropriate obligations on PCSs, this could help deliver other beneficial outcomes, such as driving more PCSs to develop re-use networks and focus on improving consumer collection options.

A coordination body known as a clearing house is typically established to manage and run the algorithm for matching. This third party instructs the PCSs (and their subcontractors if applicable) how much WEEE they are obligated to collect within the matching system and from which collection points. Beyond this core function, the clearing house could also pool resources from PCSs to administer certain common tasks – such as auditing of service providers – in a more efficient and harmonised way. By having a clearing house to coordinate information flow, data quality and transparency may also be improved.

It is crucial to recognise that matching is an administration and coordination mechanism, and by itself cannot drive more collection. Nevertheless, interviewees from other territories broadly agree that, when designed and enforced appropriately to their territories' contexts, matching has created a harmonised and stable system, and a level playing field for competition. This has allowed for more efficient and productive use of resources for PCS improvement and innovation rather than competing for WEEE.

This study concludes that matching by collection points is a potentially feasible solution for the UK, aiming at levelling the playing field and driving more PCS participation in physical collection. It also shows that, whilst matching would not in itself increase WEEE collections, it may be a useful support for wider

[2] WEEE evidence is proof of re-use or treatment by an approved authorised treatment facility or export of whole appliance by an approved exporter.

reforms to the UK WEEE system. Conversely, this study also highlights that implementation of an effective matching system hinges on changes and supplementary initiatives in the wider system.

The study explains why matching by collection points would be the preferred form for the UK if matching were to be adopted. The feasibility analysis details the benefits that matching could bring to the WEEE system, while also clearly noting the potential consequences of matching on individual stakeholders, with mitigation where appropriate. Finally, it outlines what further work is seen to be desirable as part of the wider review of the UK's WEEE system.

2 Main findings

How does matching work, and what are the benefits and drawbacks?

Four methods of matching were identified from interviewing 11 territories (10 in Europe and 1 in the United States). Out of the 11 territories, Slovenia, Sweden, and Norway only have financial clearing, which is also a form of matching. The three physical methods (i.e. involving allocation of physical responsibility) are: matching by pick-up request, by collection points, and by geographical split. A mechanism for post-matching balancing is necessary in all three methods, which can be a combination of temporary reassignment of pick-up request/collection points, carrying over deviations to the following compliance year, or financial clearing.

A general learning from the 11 examples is that there are a variety of approaches to matching. There is no standard template, and each territory has developed a system that suits its own context. Additionally, the following success factors are discussed in further detail in this report:

- number of PCSs and the competitive landscape;
- mandatory participation for PCSs;
- support from stakeholders;
- overcoming resistance to change.

Before delving into each of the four approaches, some key considerations for comparing matching systems are highlighted:

- Whether the system has a legal requirement for all PCSs to participate in physical collection.
- The scale and scalability of matching in terms of number of PCSs and collection points involved.
- The scope of matching in terms of types of WEEE (Business-to-business [B2B] or Business-to-consumer [B2C]), sources of WEEE (by various public and private collection channels), and streams of WEEE.
- Stakeholder flexibility to participate in matching.
- Whether the matching methodology ensures fair distribution of access to WEEE and cost differentials.
- Whether the matching methodology ensures minimisation of logistical inefficiencies and negative environmental impacts.
- Whether the matching methodology facilitates long-term stability in the wider WEEE system.
- Whether the matching methodology reduces administrative burden and complexity in the system.
- Whether the matching methodology minimises the level of physical balancing or financial clearing required.
- Whether the matching methodology ensures fairness and transparency of physical balancing or financial clearing.

Matching by pick-up request

This method is implemented in Germany as the national system on a producer basis, and in Austria and Spain at a limited scale. Individual pick-up requests from collection points participating in the matching system are assigned by the clearing house to the producer or PCS with the highest priority to collect. From existing examples, a high priority PCS is one that has the highest market share of EEE placed on the market (POM) by its members and the lowest amount of collection up to date, differentiated by WEEE collection stream. Therefore, PCSs with large obligations may collect more frequently at the beginning of a compliance period if they had limited collection from sources outside of the matching system.

From a local authority's (LA's) perspective, matching by pick-up request means that a collection point could be served by any PCS (and their subcontractors) in response to a pick-up request. From a PCS's perspective, it could be called upon to collect from any point in the country if it is ranked as the highest-priority PCS. This method tracks a PCS's progression towards its collection obligation with each pick-up request, therefore deviations from collection obligations are minimised (though not necessarily eliminated). A critical condition for this method to function is that the assets such as collection containers must be standardised so that any PCS (and their subcontractors) can replace them on a like-for-like basis. Otherwise, logistic incompatibility and conflicts over ownership of assets would arise. At a small scale (as in Austria and parts of Spain), PCSs may overcome this problem by contracting with a select few waste management contractors (WMCs). However, this would be a material issue if the method were to be considered in the UK context.

Matching by collection points

The method is implemented in Denmark, Italy, Illinois (USA), France, and parts of Spain. A PCS is matched to several collection points according to either a collaboration and negotiation-based process, or a well-defined algorithm. In either case, the guiding principle is that all PCSs have responsibility to collect from all parts of the country, therefore each PCS's matched collection points should have a fair mix of low-cost and high-cost areas. A PCS could be matched to one or multiple WEEE streams at a site, depending on the criteria of the matching methodology. On this basis, an algorithm for matching may take account of other criteria that support an efficient system, for example; ensuring the integrity of a municipality/county/LA, clustering nearby collection points where possible, minimising the number of PCSs matched to each collection point, and minimising the number of changes from year to year when matching is refreshed with new POM market share and collection data.

From a LA's perspective, matching by collection points is a more stable set-up compared to by pick-up request, as LAs would know ahead of time which PCS(s) would be accountable for which collection points and WEEE streams. From existing examples in Europe and further afield, LAs can raise collection requests to the clearing house, who would then direct the matched PCS and its subcontractors to respond according to a common minimum service level agreement. In the UK context, many PCS already have well-established internal systems for receiving and tracking collection requests and service status, and DCF operators are not unaccustomed to dealing with multiple service providers. To avoid expending resources on 're-inventing the wheel' and to minimise disruption to the current system, a UK matching system could allow PCSs to continue to deal directly with DCFs operators. A UK clearing house could therefore be less involved in the day-to-day operations, and instead focus on obtaining accurate and complete data from stakeholders to execute the algorithm for matching.

From a PCS's perspective, after the first year of implementation the PCS would have a good understanding of its collection areas for the medium to long term, recognising that small-scale changes could still occur if there have been significant changes in market share. If a PCS also has major or full accountability for the sites, then the method could help create a stable long-term relationship between DCF operators and PCSs, which is the foundation for pursuing initiatives such as collection events and driving re-use with local organisations.

Matching by geographical split

This method is implemented in Ireland, where each of the (two) PCSs is responsible for all collection points within a large geographic area. The boundary of the territory was drawn with consideration of the amount of WEEE expected to arise (via proxy variables such as population density and of collection points

in the area) and logistical complexity (via proxy variables such as distance from Dublin). Collection points are only reassigned if the PCSs' market shares change by more than 3%. This method can be viewed as a simplified version of matching by collection points, made possible in Ireland by the small number of PCSs and surface area to be covered. A notable benefit is that this creates a relatively stable system where PCSs can effectively support LAs and distributors. However, complications may also arise should distributors (retailers) change their business model (for example, moving a collection hub location or changing from local collection points to a national hub).

Financial clearing

In Slovenia, Sweden and Norway, there is no physical matching of pick-up requests or collection points. Consequently, there is no clearing house either. The systems are based on bilateral contracts and there is financial clearing to settle differences in costs based on a PCS's obligated versus actual collection. The clearing process is conducted between PCSs, via either a predefined price list (in Sweden) or 1-to-1 negotiations for each WEEE stream. Unless supplementary targets and policies act as safeguards, this method alone does not yield benefits such as creating a level playing field, ensuring national coverage or mitigating against selective collection.

What would be the system-level and stakeholder-specific implications of matching in the UK?

Regardless of the choice of matching method, the system-level implications of matching in the UK can be understood from three aspects:

1. Matching would define and provide a level playing field for PCS competition and quality of service

If matching were implemented, a few changes would be needed so that a level playing field and quality of service can be ensured. These include:

- All PCSs with a B2C obligation would be required to comply by participating in collection, either directly or by contracting another PCS to collect on their behalf. PCSs can no longer rely only on buy-out options such as evidence purchasing and compliance fees (if these mechanisms are maintained). All B2C PCSs would be mandated to participate in matching. Service standards could be implemented and monitored to ensure all PCSs collect and treat WEEE to the required standard.
- The minimum requirements for PCSs would rise, since matching will mandate PCSs to participate in (and not just finance) physical collection, to a nationally agreed standard. Some of the existing PCSs may not have such operational capabilities and might cease operation if they are not able to collect to the agreed standard. If such PCSs exit the market, then there would be less duplication of overheads and staff costs within the WEEE system.
- Currently, some LA DCFs that are not able to contract with a PCS are serviced by a PCS via the PCS Balancing System (PBS), and the costs are distributed according to PCSs' market shares. Under matching, all LA DCFs would be allocated and selective collection would be mitigated, and there would no longer be a need for the PBS.

2. Matching would introduce central coordination of WEEE and potentially also information flows

Matching removes the need for PCSs to individually tender with LAs - and potentially with distributors if private collection points are included in scope. Stakeholder interactions would change as a result:

- Standardised contracts can be implemented between PCSs and LAs (and potentially other DCF operators such as distributors). Successful implementation of matching hinges on providing guarantees to LAs and potentially distributors regarding service quality and waste duty of care,

especially considering that some PCSs may be comparatively inexperienced in collection from LAs and/or distributors. Matching therefore necessitates supplementary initiatives such as developing minimum service level agreements and contingencies. PCSs may also be required to submit operational plans to demonstrate their ability to meet the minimum service level.

- Any bespoke contractual terms or arrangements between LAs, WMCs and PCSs would be replaced by standard terms, if these are not part of national service level agreements. However, if a current bespoke arrangement is justified under the full net cost principle, then it could be negotiated and standardised in the service level agreement resulting in a benefit to all DCF operators. This would level the playing field, improve PCSs' access to WEEE, reduce their uncertainty in costs and hence financial risk exposure, and save resources previously expended on designing bespoke arrangements in contracts. This will also mean all costs and associated revenues would pass to PCSs in line with the full net cost principle.
- Subject to meeting the required service standard, all PCSs would be able to access DCFs, thereby removing current barriers to entry. More PCSs would participate in collection and their reliance on buy-out options such as evidence trading and use of the compliance fee would decrease.
- Matching would formalise the rules that dictate the stability of the system. For example, changes would occur periodically, typically annually, based on the matching methodology. Approved Authorised Treatment Facility (AATF) stakeholders have highlighted that, in the current system, uncertainties and short-term disruptions resulting from contract changes and terminations prevent them from establishing long-term agreements with PCSs.
- If matching includes distributor-managed collection routes, then at least three risks need highlighting:

    1. Existing functioning reverse logistics could be disrupted by introducing new players (matched PCSs and subcontractors) into the operation. For distributors with centralised reverse logistic hubs, matching these hubs to PCSs could have limited disruption. However, for distributors that operate WEEE collection on a decentralised (i.e. store by store) basis, significant disruption could occur if they were matched to multiple PCSs.
    2. If WEEE collected by a distributor (who is also a producer) under its own initiatives were matched to PCSs other than its own, then the distributor would face the risk of its own PCS receiving insufficient evidence from matching and needing to purchase more evidence or pay a compliance fee. This could result in greater financial uncertainty for the distributor. Furthermore, such a distributor could be deterred from expanding its collection.
    3. National distributors would lose the benefits of standardisation and incur increased overheads through dealing with many different PCSs, contractors and collection methodologies; vice versa for the PCSs, higher overheads could result from needing to liaise with a larger group of distributors.

- A matching system would disrupt vertically integrated supply chains (whereby one organisation can operate DCFs, AATFs and/or a PCS) and the resulting economies of scale and scope achieved by some PCSs.
- Transition to a matching system would require new partnerships to be established among stakeholders. This would result in a one-off transition cost to LAs, PCSs and producers, WMCs, and AATFs.
- Matching requires a coordination body, which would probably be a producer-funded clearing house. The coordination body could act as the central hub of information to minimise duplication of efforts by separate PCSs on administrative tasks and data validation.

3. Matching would influence PCSs' business drivers and approaches to innovation and competition

Matching links a PCS's market share to its access to DCFs likely to collect a certain tonnage of WEEE. This means:

- Matching would allow producers (particularly large ones) to move more easily between PCSs, thereby increasing competition between PCSs.

- PCSs would receive a baseline guaranteed access to WEEE for every member.
- If the current weight-based targets and compliance fee mechanism is maintained, then there is a risk of selective collection and creating an economic rent (i.e. a payment in excess of the necessary costs incurred to the collector) for WEEE outside of the matching system. This then risks demotivating PCSs from investing in collection systems other than matching.
- If the weight-based targets were removed, then separate policy initiatives may be needed to ensure that PCSs remain motivated to proactively develop the UK's collection network, drive collection quantity and quality, and mitigate against complacency from only handling WEEE matched to them that actually arises.

How could matching be integrated into potential future systems?

This study has evaluated the implication and feasibility of matching not only within the current context, but also within a future system in anticipation of several potential wider reforms. For example, the concept of a central communications and investment fund aimed at reducing losses of WEEE has been raised during stakeholder engagement, which could complement a matching system. It was also recognised that retailers are likely to play an evolving role in collection with the wider roll-out of in-store collections outside the Distributor Take-back Scheme (DTS). Therefore, this study presents the rationale for and against including distributor collection points in matching and highlights the risks with each approach. If matching includes distributor collections, then the matching system should be designed to minimise disruption to the existing range of reverse logistic systems, minimise administrative burden to distributors as well as PCSs, and provide guarantees around compliance with waste duty of care. If matching excludes distributor collections, then either within the matching system or as part of the wider system reform, there should be mechanisms to prevent the creation of an economic rent for WEEE collected by distributors, potentially driven by the need for PCSs to achieve a specific weight-based collection target.

Kerbside collection is another policy initiative that has gained significant stakeholder interest. If kerbside collection were to be mandated, matching could be designed to include Waste Collection Authorities (WCAs) and their DCFs, although due consideration would be needed for the nature of the relationships between WCAs and Waste Disposal Authorities (WDAs).

Lastly, the upcoming review of the WEEE regulations provides an opportunity to discuss potential reforms to what performance targets are used to measure success of the system. As described above, with the appropriate supplementary policies in place, matching can be designed to work with different types of targets, or indeed no target at all.

This study does not produce a policy recommendation, but rather focuses on presenting the mechanisms, benefits, and drawbacks of different approaches to matching to inform the upcoming consultation. If matching were to be adopted, further work is needed to evaluate the corresponding system changes.

How could matching be practically implemented in the UK?

The benefits and drawbacks of each matching method are explained in detail in the report, by framing them in terms of whether a method addresses stakeholder dissatisfaction with the current system or is likely to create more problems with few discernible benefits. A detailed breakdown of stakeholder interests and level of satisfaction can be found in Section 5.2.1 (Table 10).

It is judged that **matching by collection points** would be the best-fit option for the UK, compared to other methods such as matching by pick-up requests or by geographical split. The UK already has a form of

financial matching through evidence purchasing and compliance fee, and therefore pure financial matching without impact on access to DCFs is rejected as an option. The most notable strengths of matching by collection points are the stability it creates and the potential to design a sophisticated approach for the benefit of lower administrative burden and more efficient logistics from both cost and environmental (including carbon footprint) perspectives.

The main barriers to implementation and potential mitigations are elaborated in the table below.

E 1 Barriers to implementing matching by collection points in the UK and potential mitigations

Barriers to implementation from stakeholders' perspectives	**Potential mitigating strategies**
Cross-sectoral barriers	
Stakeholder concern of reduced/stagnating collection rate due to less incentive to innovate and improve LA collection and re-use	To reassure affected stakeholders, the timing and design of the matching system needs to be planned out. It is advisable that: • A phased approach is taken for implementing systemic changes affecting physical flows of WEEE, such as kerbside collection. This is to ensure that reliable operational information (e.g. quantities, product types, consolidation points) can be fed into the planning stage for matching. • Stakeholder concerns about collection rate and efficiency are explicitly mitigated either by the design of the algorithm for matching (e.g. include criterion to preserve existing relationships and give even higher priority to preserve long-running ones, minimise contact points and maximise PCSs' accountability for a whole site, etc.) and/or by supplementary policy initiatives. • A transitional period roadmap (based on a conservative estimate of 3 to -4 years) should be developed at the outset so that all stakeholders involved have enough time to establish the clearing house and the algorithm for matching, establish new contacts and relations, conduct due diligence where required, manage the process of change for staff and internal systems, and resolve potential operational issues with new partners.
Stakeholder concern of less incentive to improve collection efficiency	
Stakeholder concern of losing rapport/local knowledge and efficiencies developed from existing/long-running relationships between certain PCSs and Waste Disposal Authorities (WDAs).	
Potential complexity of developing a UK algorithm that is fair and future-proof	To ensure LAs are matched to PCSs fairly, background research is required for grading geographic areas/LAs based on existing quantities of WEEE arising per stream and location. The PBS may be a useful source of cost data when identifying and matching higher cost geographical areas. Development of the algorithm may require additional stakeholder engagement and cost-benefit analysis to determine whether the algorithm should include grading of specific DCFs (e.g. site type, capacity, accepted WEEE streams, geography, proximity to treatment facilities) in combination with overall LA scoring. The algorithm needs to be scalable to accommodate a large number of PCSs and DCF operators. Clear rules should be set out in anticipation of changes in the system, such as matching of new DCFs and succession plans

Barriers to implementation from stakeholders' perspectives	Potential mitigating strategies
	if a PCS discontinues operation. Under specific or unforeseen circumstances, the clearing house could also facilitate discussions among stakeholders (e.g. LAs, distributors, and PCSs) to reach mutually agreed practical arrangements that are a preferred alternative to the algorithm results. One instance of such alternative arrangements could be to swap matched DCFs between PCSs to preserve existing efficient 'milk round' collection routes for cost and environmental benefits. Lastly, it is highly advisable that any alternatives to the current weight-based targets for individual PCSs are consulted upon before planning for a matching system. This would mitigate the risk of misalignment between the system incentive and the matching methodology as well as any supplementary policies, which would need additional efforts and resources to rectify.
Potential complexity of establishing a UK clearing house with harmonised rules for all devolved nations	In other territories where a clearing house is set up, the initial investment and annual operating budget are typically paid for by producers via their PCSs, according to market share. Irrespective of this, the remit of a UK clearing house and its associated costs would potentially require significant discussion and negotiation. This process may be simplified if the remit of the clearing house focuses on core tasks, and it only assumed additional responsibilities if clear synergies are identified. Determining the governance structure presents another barrier due to the number of industry stakeholders and the need to represent all four nations of the UK. With reference to examples identified in this study, the governance structure may consist of multiple supervisory and management groups (e.g. oversight from regulatory bodies, board for overall management and budget approval, advisory board, executive committee, etc.), and their seats would be periodically re-assigned. Lastly, the challenge of harmonising the rules of a matching system across all nations is not to be underestimated. If there were more than 1 matching system in the UK, the overall system could be over-complicated by different algorithms and rules for matching and balancing/clearing, not to mention a duplication of overheads in multiple clearing houses. Furthermore, each nation's preferred approach to WEEE could also differ based on its waste and resource strategies. To overcome this challenge, engagement and consultation with all environmental regulators and policy makers in all four nations is an essential first step in the planning phase. Policy makers and regulators may establish a list of principles by which a UK matching system and clearing house must abide.
Barriers for producers/distributors	
Uncertainty in the impact on retailer collection and logistics	For distributors that are not EEE producers but are required to collect WEEE on their premises, the impact relates only to on-site collection, storage, handling, liaising with PCSs, and other WEEE-related administrative tasks. It is important for the design of a matching system to

Barriers to implementation from stakeholders' perspectives	Potential mitigating strategies
	recognise the wide variety of distributor reverse logistics set-up. For example, disruption could be minimised by matching hubs to PCSs for distributors with centralised operation; whereas for distributors with de-centralised operation, matching majority (if not all) store locations to one PCS would lower the administrative burden, but could increase the environmental and cost burden on PCSs. For distributors that are also producers who collect WEEE under their own initiatives for both business and compliance purposes, the impact to their operation is complicated by the risk that their collections could be matched to PCSs other than their own, so not being used to discharge their own obligation. A potential mitigation is that WEEE collected by these distributors could be first used to discharge their own obligation, and only the excess would need to be entered into a national matching system. However, a potential unintended consequence of this mitigation is that some distributors may be deterred from increasing collection under their own initiatives beyond in-store collections. There are three motives for distributors to collect WEEE: compliance and waste duty of care (from being an EEE producer and/or outside the DTS), financial, and non-financial such as brand reputation. Distributors and retailers that are also EEE producers could hesitate to expand their collection services beyond in-store collection (e.g. offering 1:0 collection for a charge by request) if the risks associated with more complicated compliance rules due to greater participation in matching are perceived to outweigh the benefits. Beyond the matching system, the role of distributors should also be considered as part of the wider system reform, aiming at increasing collection whilst avoiding demotivating distributors, for example by evaluating potential reforms for covering the legitimate costs incurred by distributors under the full net cost principle. Alternatively, a matching system could exclude distributor-controlled collection routes. Instead, distributors may continue to hold bilateral contracts with their PCSs. In the case of distributors belonging to separate PCS arrangements, the distributor-only PCS may not be matched to any LA DCFs and may continue its current in-house operations. The matching system could instead serve as a fall-back option for any orphaned retailer DCFs or in-store take back locations. The risk of taking this approach is that if high weight-based collection targets remain a part of the overall WEEE system, and if collections from distributors are material compared to collections from other sources, then this could lead to a price being established for WEEE collected by distributors, thus undermining the principle of a level playing field. At worst, this could lead to distributors actively seeking to divert WEEE from LA sites (matched) to their own collection channels (unmatched), to unduly benefit from the amounts collected. When approached with this scenario, UK stakeholders hold different views - with some challenging that this risk would not

Barriers to implementation from stakeholders' perspectives	Potential mitigating strategies
	materialise, based on past interactions with distributors. It should be noted that such risks currently exist for positive-value WEEE streams, and yet there is no evidence that distributors actively seek to divert such WEEE from LA sites. Nevertheless, this is an important consideration for a UK matching system.
Uncertainty in the cost implication for differing PCSs and their producer members	This risk varies by PCSs and therefore their producer members, as it depends on each PCS's existing LA DCF network. Producers may become more supportive of matching if common cost savings were made clear to them, e.g. less duplicated overheads and less resource expended on tender activities
Barriers for Producer Compliance Schemes (PCSs)	
Potential trade-off between flexibility (matching by WEEE stream) and efficiency (matching by whole site)	Stakeholder engagement has shown there are conflicting views about how matching by collection points could be best implemented. Recognising that one of the aims of matching is to share out access to WEEE according to PCSs' market shares, it is advisable that matching occurs by WEEE stream - as is commonly seen in other territories. However, there is a risk that PCSs could be prevented from improving collection efficiency or identifying re-use initiatives if streams are not grouped when matched to a PCS. This risk could be mitigated by a combination of algorithm design (i.e. minimise the number of PCSs matched per DCF) and separate interventions (e.g. complaint mechanism for DCF operators, visible benchmarking of PCSs' performance key performance indicators (KPIs) at DCFs/WDAs with similar operating conditions).
Risk of losing economies of scale (by WEEE stream or by regional synergy)	This risk could be mitigated in the design of the algorithm, for instance by including a criterion to minimise the total distance between all DCFs matched to a PCS, in effect attempting to match a cluster of DCFs.
Complexity as to the future role of vertically integrated PCSs	This barrier is associated with a point of contention within the UK system. A wider policy decision would need to be made. Technically, matching can work either way.
Barriers for LAs: Waste Disposal Authorities (WDAs) and Waste Collection Authorities (WCAs)	
Potential complexity in establishing a national service level agreement for PCSs and their contractors, including contingencies	This is a barrier because the service level agreement would need to satisfy a variety of potential conflicting LA conditions, needs and preferences. A potential approach is to establish a working group of LA representatives and PCSs for comparing the terms of contract in recent tenders and communicating expectations/ concerns. The group may then work towards a consensus on setting an agreed service level and contingencies (potentially adapted to the grading of WDA/DCF), and value-added services that are justifiable by the full net cost principle and not already

Barriers to implementation from stakeholders' perspectives	Potential mitigating strategies
	covered by a potential central investment fund (e.g. social value based on grading of WDA).
Risk of losing value-added services and funding from competitive tenders	This risk can be mitigated by developing consensus and standardising the justifiable value-added services in the national service level agreement, which should ensure all DCFs obtain justifiable value added services, not just those with access to low cost WEEE.
Potential limitation of DCF capacity if a minimum clearance amount is required	Whilst a matching system should consider the environmental impact of collecting very small amounts of WEEE, there is currently a knowledge gap in understanding the complexity in DCF operation and the typical tonnage per collection. Tonnage per collection is not necessarily linked to DCF sizes. For example, there are known challenges associated with quantifying quantities collected from multiple DCFs on a 'milk round'. Additionally, other arrangements such as scheduled and call-off collections are also common, depending on how WEEE fits into LAs' overall waste remit. Further research into this area is needed to inform a reasonable threshold for WEEE offtake under matching, without creating unintended consequences on other waste streams. Furthermore, the design of a matching system should consider ways to encourage LAs to improve collection efficiency. The mechanism for doing so is not limited to financial incentives.
Risk of change management and administrative burden	The risk of change management has been discussed under cross-sectoral barriers and pertains to planning for the transitional period. The risk of administrative burden can be mitigated by firstly minimising the number of PCSs matched per DCF by the algorithm, and also by appointing the clearing house as the central contact point for certain administrative tasks such as contract management.
Barriers for Waste Management Companies (WMCs)	
Risk of less, secured WEEE evidence notes	In addition to the cross-sectoral and PCS-specific barriers discussed above, WMCs that also operate their own PCSs may face an additional challenge of losing revenue associated with WEEE treatment at WMC-operated AATFs. The vertically integrated WMCs also face the risk of needing to seek out additional sources of WEEE outside of the matching system to meet their targets, if the target and compliance fee mechanism were maintained. The mitigation strategy for this risk is the same as other concerns related to severed working relationships; the algorithm for matching can include a criterion to maximise preservation of existing relationships including those occurring within the same organisation. Note that this approach can only reduce - and not eliminate - the risk, as the algorithm for matching must prioritise fair distribution to maintain a level playing field.

Barriers to implementation from stakeholders' perspectives	Potential mitigating strategies
Barriers for third sector re-use organisations	
No responses from third sectors were received. Assume that a main barrier is the risk of reduced supply and collaboration with PCSs.	Potential disruptions to third sectors should be foreseen during the transition period, as new relationships would need to be established. Managing new partnerships with the third sector is also relevant for PCSs, if future targets evolve to include re-use metrics. Under matching, PCSs could be required to support relationships between LAs and re-use organisations as part of the PCS/DCF service agreements, which would help to ensure proper re-use. If re-use quantities fall significantly below historical averages, then separate initiatives could be implemented.
Barriers for Approved Authorised Treatment Facilities (AATFs)	
Risk of increased administrative burden of managing accounts and evidence notes	As with LAs, the risk of administrative burden could be mitigated by centralising the flow of information through the clearing house. This would require a secure IT platform for handling sensitive data and securing the chain of evidence. However, this mitigation would disrupt the current well-established data flows, and potentially complicate matters for PCSs to ensure waste Duty of Care. Alternatively, the UK matching system could continue to let PCSs manage their relationships and data flows with AATFs, and the clearing house would separately obtain data from the PCSs.
Risk of reduced logistical efficiency depending on level of market fragmentation post matching	Some DCFs may still be matched to multiple PCSs in order to ensure fair distribution of WEEE by market share. However, the likelihood of this risk can be mitigated when designing the algorithm. Furthermore, a potential PCS service level agreement may include a clause pertaining to the efficiency and environmental impact of collection; for example, if multiple PCSs serve the same DCF, the service level agreement may require the PCSs to coordinate offtake and minimise the 'WEEE mileage' leading up to an AATF.
Barriers for environmental regulators and devolved administrations	
Risk of potential complexity in managing the transfer of authority and responsibilities to clearing house	This is judged to be a relatively minor risk that can be mitigated by clearly defining the remit and governance structure of a clearing house, and by having a 3-4 year transitional period. It should be noted that internal processes may differ for each environmental regulator and administration. Therefore, representatives from each regulator/administration should engage in the development of a clearing house to ensure that its roles and responsibilities satisfy the needs and context of each nation.

What would be the costs and benefits to UK stakeholders?

A significant challenge faced by this study is the lack of quantitative data to support a comprehensive cost and benefit analysis. Since most matching systems have been in place since the beginning of the WEEE system, there is a lack of quantitative evidence on the operational benefits of matching. Furthermore, the project team were not able to source cost/revenue data due to commercial sensitivity. Instead, a qualitative assessment is given by the following criteria:

- **Minor impact:** The impact is temporary (i.e. only relates to the transitional period) or infrequent (i.e. less frequent than annual occurrence) and relates to supporting activities (e.g. administration, financial transactions).
- **Moderate impact:** Temporary or persistent, the impact relates to an incremental change in core activities (e.g. tender and contract management, coordination of WEEE collection and treatment, evidence and data management) from the baseline scenario.
- **Significant impact:** Temporary or persistent, the impact relates to a step change in core activities.

The following table summarises the costs and benefits to each stakeholder and the assessment of scale.

E 2 Summary of stakeholder impact: breakdown of costs and benefits

Impact on PCSs and producers
Costs to PCSs and producers Costs under various transition scenarios related to PCSs: • Costs for producers to seek out a new PCS (**minor**): this cost would only occur if a producer decides to change PCS, or if the producer's current PCS decides to discontinue operations. In any case, the potential cost of switching already exists within the current system as it is common for producers to periodically assess their PCS against market alternatives. Large producers would face greater impact if this risk materialises, e.g. if a producer prefers to stay with the same PCS due to cost and complexity of switching, but is forced to switch as their current PCS could not deliver on new requirements under matching. • Cost for PCS to establish a new collection and treatment network to re-qualify (**moderate to significant**): the level of impact depends on the uptake and effectiveness of aforementioned mitigations. If a PCS opts to contract another PCS to collect on its behalf, the additional cost is judged to be moderate. • Cost for process change management if PCSs choose to merge operations to re-qualify (**minor to moderate**): the cost of change is classified as minor due to its temporary nature. However, the new operation could represent a moderate recurring cost. • Cost for establishing new working relationships and logistical arrangements with DCFs and AATFs, including arrangements between PCSs to collect on behalf of others under matching (**minor to moderate**). If the PCS currently dominates low-cost DCFs or does not collect from DCFs at all: • Cost increase for LA DCF collections (**moderate to significant**): level of cost increase depends on the PCS's current capability, coverage of collection, and arrangements with the DCFs. The cost increase would be moderate if the low-cost DCFs currently have bespoke arrangements for value-added services given their perceived cost advantage. However, if the PCS currently collects mostly from low-cost DCFs without bespoke arrangements, then the cost increase would be more significant.

For all qualified PCSs:

- Cost for initial planning, research, and development of a matching system and algorithm (**significant**).
- Cost for the set-up and operation of a clearing house (**moderate to significant**): the set-up cost depends on the agreed remit of the UK clearing house. In Italy, stakeholders estimated that just under €2 million were spent on initial set-up and IT development. Costs to the UK could be lower if the clearing house focuses only on managing the matching system and is not involved in coordinating day-to-day interactions amongst stakeholders.
- Correspondingly, the annual operating cost of a UK clearing house could be lower than that of Italy which is around €1M per year. In Italy's case, the largest cost is staff, followed by subcontracted services such as IT and a call centre.
- Potential financial contribution into a central fund targeting at reducing WEEE losses (**moderate to significant**).

Benefits to PCSs and producers

For all qualified PCSs:

- Cost saving for those PCSs that currently collect from LAs from no longer needing to prepare tender responses or attempting to match (new) members' obligations with the PCS's contracted collection obligation (**moderate**): stakeholders estimate the cost saving to be equivalent to the wage of a full-time staff member for business development with LAs and distributors, plus duplication across PCSs.
- Cost saving from no longer needing to offer revenue-sharing agreements or bespoke arrangements and additional services that are not justified under the full net cost principle (**moderate**).
- PCSs would retain all material sales revenue from collected WEEE under the full net cost principle (**moderate**, overlaps with the point above).
- Reduced exposure to financial risk due to lower reliance on buy-out options such as evidence purchases and compliance fees (**moderate**). Less financial risk would lower the cost to fulfil existing members' obligations. It would also allow the PCSs to take on a large producer with less uncertainty over the source for additional WEEE.

System-level benefits for all producers:

- Linked to the last point above, matching links a PCS's access to DCFs and therefore would allow producers (particularly large ones) to move more easily between PCSs, thereby encouraging competition between PCSs. The benefit of improved competition among PCSs for producers can be financial (e.g. lower fees) and non-financial (e.g. provision of advisory services). The magnitude of this benefit is not categorised as it would be highly case-dependent.
- Reduced duplication of overheads and staff cost, potentially also including subsistence fee payments from fewer qualified PCSs (**moderate to significant**): as matching would mandate PCSs to participate in collection beyond only financing it, PCSs would need to demonstrate their capability to meet a national service level agreement. This effectively raises the entry requirements for PCSs. As a result, matching would potentialy reduce the number of PCSs and duplicated costs. Level of change in subsistence fee payments would depend on whether costs incurred to environmental regulators are independent of the number of PCSs in the market.
- Elimination of PBS-associated costs (**minor to moderate**): at a minimum, the annual administration and external audit costs (£7,500 in total) would be saved. As the PBS operates on a bidding system and can often be only for certain WEEE streams, the cost is not optimised. Therefore, replacing the

PBS with matching would likely reduce cost for producers and PCSs because collections could be organised more efficiently, particularly if as many WEEE streams as possible are allocated to one PCS for each DCF. It should be noted that certain PCSs could still experience an increase in collection cost despite efficiency gains, particularly if they are matched to LAs previously managed under the PBS. This also suggests that the need to maintain a level playing field through the algorithm should be prioritised over short-term DCF-PCS relationships derived from existing PBS.

- Potential cost savings from centralised administrative tasks coordinated by the clearing house (**moderate**): This is classified as a moderate impact because it would have an on-going impact on the way PCSs organise their supporting activities. However, the level of cost saving depends on the remit of the clearing house and the types of tasks that would be centralised.

Benefits contingent upon the design of the algorithm for matching:

- Potential efficiency and cost saving if the algorithm enables clustering of DCFs to form efficient collection routes (**moderate**).
- Potential efficiency and cost saving if the algorithm minimises the number of PCSs matched to each site, thereby enabling economies of scale (**moderate**).

Impact on distributors in addition to those covered under PCS/Producers

Distributor-specific costs

If private collection points are included in matching:

- Lost financial benefit from losing a proportion of its own managed collections to other PCSs (**moderate to significant**).
- If the distributor is also a producer, then there could be higher exposure to financial risks due to potentially greater reliance on buy-out options (**moderate to significant**): the scenario is that a distributor may be able to fully self-comply due to its own collection today, but could fail to do so if its collections were matched to multiple PCS and total matches to its own PCS (including WEEE from other distributors and LA DCFs) were insufficient to discharge the distributor's individual obligation. This would lead to greater reliance on evidence purchase or even compliance fee. The significance of this cost implication would depend on the overall system. As previously discussed, this cost could be mitigated by allowing any producers who collect WEEE under their own initiative to match their collections first to their own requirements, with any excess to their own direct requirements being moved to the national matching system. However, a potential unintended consequence of this approach is that it could complicate the compliance activities for certain distributors, thus potentially demotivating them from expanding their collection services beyond in-store collection as a way of limiting their involvement in the matching system.
- Higher overhead and training costs resulting from the need to deal with multiple PCSs, multiple contractors, elimination of standardisation of collection arrangements, and need to aggregate data from multiple operators for corporate social responsibility (CSR) reporting (**moderate to significant**): Distributors with centralised reverse logistic hubs may face fewer challenges on this front, as matching could be applied to these hubs rather than to individual store collection points. However, the impact would be more significant for distributors that lack such centralised systems and currently request PCSs to collect from stores. Note that a distributor matched to only one PCS could still retain the benefits of a nationally standardised service (e.g. standardised containers and collection methods, simpler data aggregation for CSR reporting); however, it remains an important question whether and how the variety of UK distributors could be exclusively matched to PCSs whilst ensuring fair allocation.

Distributor-specific benefits

If a weight-based target and compliance fee mechanism is retained and private collection points are not matched:

- Potential to receive more support from PCSs for expanding collection network and driving more and higher quality collections (**moderate**): this benefit is expected to be a moderate one as a functioning matching system should mitigate against any distorting effects from distributors seeking to unreasonably benefit from the WEEE they hold, assuming the current evidence based system continues. Reforms to the overall WEEE system could also serve to mitigate the risk of undue economic rents (i.e. producers funding more than the necessary costs against the full net cost principle) under matching, for example requiring evidence to only be generated for WEEE managed under the matching system.
- Avoided payments under PBS for categories a distributor has already achieved compliance (**moderate to significant**): Compared to the current system, this represents an on-going impact specific to distributors who are also producers. It should be highlighted that the level of cost saving (if any) would depend on the EEE POM and in-house collection profile of the distributor. Those who consistently collect beyond their obligation in certain WEEE streams would see greater cost saving in this impact category.

Impact on LAs

Costs to LAs

For LAs operating their own DCFs:

- Loss of financial contribution and other bespoke arrangements from existing contracts (**moderate**).

Depending on the implementation of the matching system and clearing house:

- Potential of additional costs for greater administrative burden and bureaucracy due to funnelling all communications via a third party rather than directly with PCSs (**minor**). Alternatively, the matching system could maintain direct links between PCSs, LAs (and other DCF operators) and AATFs which would avoid this cost implication. Note, however, that the latter scenario could come at a minor cost of additional administrative burden for the clearing house to obtain data from various stakeholders.

Non-monetary impact:

- Bespoke contracts would be replaced by standard agreements, and therefore additional assurances must be put in place. To establish and enforce a national minimum service level agreement, LA representatives would need to be engaged and therefore their time would be diverted away from other tasks (**moderate**).

Benefits to LAs

For all LAs:

- Cost savings in not having to undertake tender exercises (**significant**).
- Potential access to a central fund for reducing loss of WEEE (**moderate to significant**).
- Potential inclusion of social value or other forms of bespoke arrangements justified by the full net cost principle in the national service level agreement in a standardised manner (**moderate**).

Non-monetary impact:

- For LAs that are currently served by the PBS, matching could offer a more stable and potentially less onerous option if the algorithm is designed to minimise the number of contact points for these LAs (**moderate**).

Impact on WMCs in addition to those overlapping with LAs for the operation of DCFs

Costs specific to vertically integrated WMCs (PCSs) if their DCFs are matched to another PCS:

- Cost from needing to seek out additional sources of WEEE or rely more on buy-out options such as evidence purchases and compliance fees (**moderate to significant**).
- Cost of needing to develop new relationships with other PCSs to secure supply of WEEE to its own AATFs (**minor to moderate**): this involves a transition cost (**minor**) and potentially a recurring cost (**moderate**) for the input materials compared to the current operation.

Impact on AATFs

Costs to AATFs

Depending on the implementation of the matching system and clearing house:

- Potential dip in revenue if known risks are left unmitigated during implementation of matching and lead to less WEEE collected overall (**minor to moderate**): During the transition period, there could be a temporary dip in collection (a minor cost implication). If known risks remained unmitigated beyond the transition period, then there could be moderate and persistent cost implications for AATFs, which would also vary depending on the streams of WEEE affected.

Transition cost:

- Cost for developing new relationships with PCSs matched in the area (**minor**).
- Cost for establishing new logistic arrangements with DCFs (**minor**): note that this cost is likely to be passed onto the PCSs.
- Depending on the level of demand, AATFs may also see the need to invest in collection and treatment assets (**moderate to significant**): note that this cost is likely to be at least partially passed onto the PCSs.

Benefits to AATFs

Non-monetary benefits from a more stable system under matching (the level of benefits are not categorised as they relate to strategic decisions specific to each AATF):

- Benefits from being able to improve value propositions and secure longer-term agreements.
- Benefits from being better positioned for investment planning, which is advantageous for all stakeholders if it leads to higher treatment qualities and more value retained from WEEE.

Impact on environmental regulators and government

Costs to environmental regulators and government

- The subsistence fees received by environmental regulators and government could drop, depending on their cost structure (**minor to moderate**): if regulators' WEEE-related costs are mostly variable costs, i.e. dependent on the number of PCSs (e.g. administrative tasks and liaising with individual PCSs where needed), then the impact would be minor as the fees payments from each PCS would still cover the costs incurred by the regulators. On the other hand, if the regulators' WEEE-related costs are mostly fixed costs, i.e. independent of the number of PCSs,

then the current overall fee level would remain unchanged. For regulators to ensure cost coverage, this could translate to an increase in annual charges to the remaining PCSs.

- More resources to be expended on developing a harmonised approach to WEEE so that a clearing house would need to enforce only one set of rules, and the basis for matching is consistent across the UK (**moderate to significant**): government bodies such as DEFRA would borne the cost of consultations, and environmental regulators should expect costs for introducing and implementing measures to oversee matching. Cost to the public authorities would depend on the scale of consultations and changes for regulators. This cost is separate from the cost of establishing the coordination body, which would be borne by producers.

Benefits to environmental regulators and government

- Benefits from transferring some administrative responsibilities (and costs) such as POM and collection data reporting to a clearing house funded by producers (**moderate**): Since a clearing house would require POM and collection data from each DCF in order to run the algorithm, this transfer of responsibility could reduce duplicated efforts and costs. Note that this could come at a minor transition cost for managing internal changes and establishing new protocols for overseeing and collaborating with the prospective clearing house.

Conclusion and future work

This research has established that matching has operated with various levels of success in a number of territories. In most territories, matching is seen as a beneficial system; however, in some cases stakeholders highlighted a lack of enforcement or coverage of matching. Unlike in other territories where matching has been in place since the beginning, implementing matching in the UK is complicated by the well-established relationships and processes under the current system.

UK stakeholders who engaged with this research broadly agree that the current system is functioning without critical market failures as seen prior to the 2013 reforms. Nevertheless, stakeholders recognise that there is significant room for improvement relating to increasing collection rate and reducing loss of WEEE. **Matching by collection points** is a potentially feasible solution to some of the problems faced by stakeholders, most notably relating to creating a level playing field among PCSs, freeing up resources from bidding for WEEE and directing them towards more progressive activities and productive competition for customers, and creating a more stable system fit for future progress. To ensure that matching facilitates rather than hinders collection quantity/quality/circularity, sophisticated algorithm design is needed. In addition, there should be supplementary initiatives such as minimum service level agreements, and mitigating measures against economic rents being charged for access to WEEE outside of the matching system.

Two future work opportunities have been identified from this research that would support a consultation on matching. Firstly, it is recognised that the unintended consequences of matching on collection rates are closely linked to the configuration of future targets. There is scope for another study to examine what alternative targets may be suitable for a progressive system, and their implications for matching in practice. Secondly, the cost and benefit analysis from this study has highlighted several data gaps. If a policy Impact Assessment were to be conducted, it is advisable to establish a stakeholder working group where sensitive data could be shared anonymously and in aggregate.

If **matching by collection points** were deemed favourable after consultation, then four more work streams should be expected for initial planning:

1. There is a substantial piece of work to assess DCFs according to the cost of collection of WEEE from these locations, which may be supported by some of the cost data held by the PBS and individual PCSs.
2. Environmental regulators and governments should convene with the aim of harmonising the approach to WEEE management and agreeing on a set of guiding principles for matching in combination with other changes to deliver a progressive WEEE system.
3. There is a need to develop the algorithm for matching, and the supporting system and methodology for keeping it up-to-date and fit for purpose.
4. There is a need to establish a clearing house, with appropriate governance structures to manage the matching system.

3 Context and objectives

In the current UK WEEE system, producer compliance schemes (PCSs) tender to secure access to WEEE from parties collecting WEEE from end users, such as local authorities (LAs) and some distributors and businesses, to meet their producer members' obligations.

The UK Government is planning to undertake a consultation in the first half of 2022 that may propose reform to the UK's WEEE Regulations. This provides an opportunity for evaluating whether and how various policy options could enable a progressive WEEE system, one of which is the use of matching.

Matching (sometimes also known as 'allocation') refers to the requirement for PCSs to collect WEEE from various sources at a level equivalent to their producer members' combined market share. It is an alternative to the current contract-based system in the UK. The primary purpose of matching is to ensure that all PCSs collect their fair share of WEEE within the matching system from across the country. The share of WEEE is matched to each PCS according to its market share based on the combined obligation of its producer members. The process of matching is administered by a third party, for example a public authority or an industry-led coordination centre such as a clearing house. This third party instructs the PCSs (and their subcontractors) how much WEEE they are obligated to collect within the matching system and from which collection points.

Matching has been implemented by several European countries during the implementation of the WEEE Directive, as well as by territories further afield (e.g. Illinois in the United States) as part of their own WEEE regulations. Proponents of matching see this as an opportunity to level the playing field and to require all PCSs to participate in physical collection, as well as for redirecting resources currently expended on competing for access to WEEE onto more productive and progressive activities. Of course, there are opposing views questioning whether and how matching could benefit the UK system in driving more collections and greater circularity, compared to incremental improvements to the existing system.

In the 2013 consultation on the UK WEEE system, matching was presented as an alternative to the current target/compliance fee system based on open tenders.[3] The Impact Assessment highlighted that UK stakeholders held divergent views about matching. As this topic is being examined again, it is necessary to bear in mind that some of the arguments for and against matching remain relevant today; but more importantly, the pros and cons of matching must be contextualised in relation to the existing system which has developed significantly since the 2013 consultation.

Oakdene Hollins, in collaboration with the WEEE Forum, was commissioned by Material Focus to research how matching has worked in other territories, and to develop an up-to-date evidence base on whether and how matching could benefit the UK system and be practically implemented. This study is divided into two phases. Phase 1 focuses on gathering evidence on existing matching systems. The objectives are to:

- Research and report on the use of matching in different territories in Europe, and further afield.
- Analyse the potential benefits and drawbacks of the various matching methods.

[3] Daniel Coleman and Graeme Vickery, 'WEEE System Impact Assessment (BIS 0393)', Defra, October 2013, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/249743/bis-13-1181-impact-assessment-waste-electrical-and-electronic-equipment-weee-system.pdf.

Phase 2 of the study focuses on exploring whether and how matching could benefit the UK system. The objectives are to:

- Explore whether and how matching could best operate in support of a progressive WEEE system.
- Analyse the feasibility, potential enablers or barriers of implementing matching in the UK.
- Identify and assess the implications for stakeholders across the sector.

This study aims to support the upcoming review of the WEEE system in the UK.

4 Method and approach

4.1 Phase 1: Research and review of existing matching systems

The aim of Phase 1 of this study was to obtain a comprehensive understanding of existing matching systems. The scope of evidence gathering covered: the WEEE system conditions in a given territory, the context and drivers for a matching system, practical details of the matching processes and algorithms, and associated costs and effectiveness of matching systems.

The WEEE Forum reached out to its network of PCSs (also known as Producer Responsibility Organisations, or PROs) to identify the territories that have a matching process in place. Responses were received from 11 territories, and interviews were conducted during May and June 2021 (Table 1). The interviewees were mostly PCS stakeholders; however, representatives from the clearing houses in Germany, Italy and Illinois were also interviewed.

In addition to the 11 territories, the administrator of the PCS Balancing System (PBS), Anthesis, was interviewed. Information obtained about the PBS was used to analyse whether the PBS methodology could serve as the groundwork for a UK matching system. It was recognised that the PBS is distinct from other territories' matching systems, as it shares only costs and relies on shorter-term contracts rather than assigned collection obligations.

Apart from the 11 positive responses and the PBS, stakeholders in Colombia, Nigeria and Canada confirmed that they do not have a matching system and were not aware of matching systems other than those already identified. Previous research commissioned by the European Commission indicated that there was an intention to establish a clearing house and matching system in Malta[4], however no responses were received from Maltese stakeholders and therefore no detailed information was obtained. As the project progressed to Phase 2 some UK PCSs also shared their European contacts, and follow-up interviews were conducted throughout July.

To prepare for the interviews, a survey was designed to capture key research questions about the overall context of the WEEE system in the territory and its matching system. The questions were designed to identify factors that could be relevant for evaluating matching in the UK context. Once the survey was finalised, publicly available data and literature about the matching systems and clearing houses were reviewed. Relevant information was added to the surveys and sent to the interviewees for validation prior to the interviews. Given the time constraints of the interviews, the purpose of this step was to allow interviewees to validate the general information from the background research, add updated information where applicable, and prepare answers for the interview. By doing so, the project team was able to drill down on the practical details of the matching systems during interviews.

While the interview questions covered the involvement of other stakeholder groups and probed potential drawbacks or limitations of the system, it is acknowledged that the findings from Phase 1 are from a PCS-centric perspective. In addition to interviews, official documentations relating to the roles and responsibilities of different actors in the system and the matching methodologies were reviewed to provide a comprehensive view.

[4] BIPRO et al. 'WEEE Compliance Promotion Exercise: Final Report' (LU: Publications Office of the European Union, 2017), https://data.europa.eu/doi/10.2779/918821.

Following each interview, the information was summarised and returned to the interviewee for validation. Some stakeholders also provided further details that were not covered during the interviews. This information was then synthesised into fact sheets for each territory. These fact sheets facilitated presentation of key findings in Phase 2 of the project when engaging with UK stakeholders, and enabled identification of key factors for the feasibility analysis in the UK.

Fact sheets of each territory, including the PBS in the UK, are presented in Section 5.1. More details from the interviews are enclosed in the Annex.

Table 1 Summary of territory stakeholders interviewed

Territory	Stakeholders interviewed
Austria	1 interviewee from a PCS
Denmark	2 interviewees from the same PCS
France	2 interviewees from the same PCS
Germany	1 interviewee from the clearing house 1 interviewee from a PCS with exposure to the German system
Illinois, United States	1 interviewee from the matching system administrator
Ireland	2 interviews from 2 different PCSs
Italy	1 interviewee from a PCS 1 interviewee from the clearing house
Norway	1 interviewee from a PCS
Slovenia	1 interviewee from a PCS
Spain	2 interviewees from 2 PCSs 1 interviewee from another PCS
Sweden	1 interviewee from a PCS
United Kingdom	1 interviewee from the PBS administrator

4.2 Phase 2: UK stakeholder engagement and feasibility analysis

The aim of Phase 2 of this study was to explore the implications, practical considerations, and potential benefits and drawbacks of various matching methodologies (identified in Phase 1) in the UK context. Stakeholder views were also obtained on whether the PBS could be adapted and scaled up as a UK-wide matching system. This phase consisted of 1-to-1 interviews, group discussion and surveys. Table 2 summarises the extent of this stakeholder engagement.

At the beginning of group discussions and most 1-to-1 interviews, the project team presented a summary slide deck explaining the principles of each matching methodology identified in Phase 1, as well as key takeaways relating to WEEE flows, contractual relationships, data requirements and financial transactions. The broader context of each of the territories was also presented to help stakeholders understand how matching fits within a WEEE system. The slide deck allowed stakeholders to capture the core concepts of matching and effectively engage in the discussion.

Table 2 Summary of UK stakeholder engagement

Stakeholder	Interviews	Surveys and fact sheets
LARAC	1-to-1 interview	Sent – 0 responses
ESA	1 group discussion	Sent – 0 responses
NAWDO	1-to-1 interview	Sent – 0 responses
Recolight	2x 1-to-1 interviews and email correspondence	Received from WSF
ICER	2 group discussions	Sent – 0 responses
REPIC	2x 1-to-1 interviews	Received from WSF
WSF	1-to-1 interview	Distributed by WSF to PCS members – individual email responses from PCSs
AATF Forum	1 group discussion and email correspondence	Sent – 0 responses
ERP	1-to-1 interview and email correspondence	Received from WSF
Anonymised retailers/distributors	1-to-1 interview with a retailer 2x 1-to-1 interviews with two wholesalers with B2B focus	Distributed by ICER to retailer members. Survey not sent to wholesalers.
Defra	Email correspondence	Not applicable
BRC	None	Sent – 1 response
TechUK	None	Sent – 7 responses

Following the presentation was a list of questions customised to each stakeholder group. The questions were again grouped by WEEE flows, contractual relationships, data requirements and financial transactions. Three main lines of questioning were followed:

- In what ways might the given method of matching affect flow of WEEE/contractual relationship/data requirements/financial transactions, in relation to the stakeholder's roles and responsibilities.
- Whether the stakeholder thinks a particular methodology for matching (or the scaling up of PBS methodology) could be practically implemented in the UK, and the rationale behind these viewpoints.
- The perceived positive and negative impacts to the stakeholder.

Throughout the interviews, clarifying questions were raised to encourage stakeholders to expand on their viewpoints with evidence (anecdotal or evidenced). Where appropriate, the project team referenced statements made by other interviewees (anonymously) to explore whether a view is shared or contested amongst stakeholders.

In addition, the 2013 Impact Assessment that evaluated matching as a policy option was reviewed. Key arguments for and against matching from each stakeholder group raised at that time were presented in group discussions and surveys, to spark discussions on whether these arguments remain valid in today's context.

After the meetings, either the slide deck or an equivalent online survey was distributed through relevant trade associations and members' bodies in an attempt to reach more stakeholders who were unable to

partake in interviews or discussions. Some stakeholders also contributed via emails. In late July, draft territory fact sheets that were in development since the conclusion of Phase 1 were shared with all stakeholders to provide more complete contextual information and encourage further engagement. Given the complexity of the topic, the online survey was lengthy. As a result, the project team found that the survey response rate was poor. 1-to-1 interviews and group discussions were more effective for engaging with stakeholders, exploring the aforementioned topic areas, and deep diving into stakeholders' views.

Information from these discussions was then synthesised to identify the pain points in the current system that could be addressed by matching. On this basis, the implications of matching for the current as well as the potential future UK WEEE system were analysed. The benefits and drawbacks of each method of matching in the UK were discussed before a preferred option was suggested. Then, potential barriers to implementing the preferred option and mitigation strategies, as well as the costs and benefits to each stakeholder group, were evaluated. Lastly, data gaps and opportunities for future work were identified.

5 Phase 1 results: Existing matching systems

Section 5.1 summarises the key findings from each territory (including the PBS in the UK) in form of fact sheets. Note that below the PBS fact sheet, stakeholder views about it being extended as the basis for a UK matching system are summarised. Section 5.2 highlights the benefits, limitations, success factors and notable barriers uncovered during the interviews. Finally, Section 5.3 delves into the key differences and commonalities of each matching approach and applicable learnings for the UK.

Please note, the fact sheets are presented in no particular order.

5.1 Territory fact sheets

<table>
<tr><td colspan="2">Italy
Centro di Coordinamento RAEE (CdC RAEE)</td><td>Principle of matching
Allocation of collection points</td></tr>
<tr><td>Surface: 124% (compared to UK's)
Population: 89% (compared to UK's)</td><td>Number of PCSs*: 12/18</td><td>Mandatory handover to PCSs: No</td></tr>
<tr><td>WEEE in scope:
All B2C WEEE categories
B2C + B2B lamps
Municipal collection
Retailers</td><td colspan="2">Collection points participating in the system:
4,250 public collection facilities + 820 private collection facilities</td></tr>
<tr><td colspan="3">Set up purpose:
Coordination was needed to ensure that all regions were covered in a fair and efficient way, with stable market prices and avoiding the "selective collection" of preferred collection sites and WEEE categories.</td></tr>
<tr><td colspan="3">Matching methodology:

<u>Responsibility calculation:</u>
The PCS responsibility is calculated using the market share of the producers within the PCS.

<u>Matching:</u>
Every year, by assigning collection points, the clearing house assigns to each PCS a fraction of the total WEEE to be collected. This fraction is proportionate to the market share of the producers belonging to that PCS. The number of collection facilities assigned to a specific PCS "A" is calculated to fulfil the following condition:

$$\frac{Sum\ of\ WEEE\ (per\ stream)\ generated\ by\ the\ collection\ facilities\ assigned\ to\ PRO\ \mathrm{A}}{Sum\ of\ WEEE\ (per\ stream)\ generated\ by\ all\ collection\ facilities\ in\ the\ country} = Market\ share\ of\ PRO\ \mathrm{A}"(per\ stream)$$

This calculation and allocation are carried out through an algorithm, which also accounts for 5 other criteria:
Ensure that each PCS gets matched to DCFs such that the projected WEEE arising from these DCFs (per stream) as a share of the total WEEE arising (across all DCFs in the matching system) is equivalent to the PCSs' market share in the associated EEE categories.</td></tr>
</table>

- Minimise the number of PCSs allocated in the same collection facilities.
- Every PCS must work with the same logistic complexity.
- Every PCS must work in every part of the country.
- Minimise the number of changes to conserve relationships between PCSs and collection facilities.

The clearing house is the contact centre for any pick-up request from the authorised collection points. The IT system is automated to notify the PCS in charge of the collection points. The clearing house sets and verifies the quality of the logistics service provided by the PCSs to the collection points. PCSs report to the clearing house the tonnages collected monthly.

Post-matching:

Review (annual/periodic/fine tuning):
The main allocation of the year occurs between end of April and beginning of May. Monthly, the clearing house checks whether the WEEE collected by a PCS matches its collection responsibility. It carries out fine-tuning of collection points only if the deviation exceeds 0.5% for cooling, large appliances, screens and mixed WEEE; for lamps, the threshold is 1%. Any monthly surplus or deficiencies are carried forward and balanced.

Balancing:
At the end of the compliance year, the clearing house calculates the share of WEEE (per stream) collected by each PCS as a percentage of the total quantities of WEEE (per stream) collected in the country. This percentage is then compared against the PCS's market share in the associated EEE categories. If a given PCS has collected more than its market share, the clearing house will allocate the PCS fewer or smaller DCFs for the next compliance year. Conversely, if the PCS has collected less than its market share, the clearing house will allocate the PCS more or larger DCFs to balance the differences.

Foundation Year: 2008	**Public/Private:** Private	**Revision of the methodology:** N/A

Legal enforcement (voluntary/legal requirement):

It is included in the legislation that all the PCSs operating in domestic WEEE must join the clearing house. Initially it was not clear who should be in charge of setting up the clearing house. Eventually it was set up by the PCSs and its implementation took two years.

Financed by: PCSs **Managed by:** Separate company with staff of seven people	**Annual budget:** €1.2 million/year - with the following breakdown: • 50% labour costs • 5% communications • 8% consulting costs • 8% operational costs • 16% subcontracting (IT, call centre) • 2.5% taxes • 2.5% internal investments • 8% other	**Payment to collection points (Y/N):** Yes, payments are made by the clearing house to the collection points

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers	*POM*		
PCSs		*POM/year & Collected/month*	
Clearing house			*Collected (for validation)*
Collection points		*Pick up requests*	
Retailers			
Regional/local authority			
EPA			
Waste management companies & treatment operators (AATFs).		*Collected & managed*	

Other tasks of the clearing house:

- The clearing house runs a register of treatment plants and collects information on amounts and type of WEEE treated. It deals with issues on treatment quality such as the approval of treatment plants (treatment standards).
- The clearing house audits treatment operators (for example checking minimum recycling rates, all pollutants are removed, second level treatment operators are qualified etc.).
- The clearing house represents the PCSs with stakeholders in some cases (e.g. with the Ministry, ANCI and Distribution Associations).
- Producers set aside funding for national communication campaigns, and work together with producers defining the messages for radio, TV, etc. This is done on top of the legally obligatory communication by retailers and collection points. The clearing house also carries out communication tasks, for example at trade fairs.
- The clearing house prepares calls for proposals to provide economic contribution to municipalities (Fondo infrastrutturazione) that allows to improve the infrastructure of existing collection points or to build new ones. Municipalities can apply for funding and receive economic compensation from producers via the clearing house if they meet certain criteria.
- The clearing house has also made an agreement with both municipalities and retailers for compensating them (Premio di efficienza). To encourage collection points to support a good quality service and efficient logistics, collection points that provide service under certain quality parameters (e.g. opening hours, minimum pick up load, WEEE is not missing components etc.) receive an economic compensation. Since the establishment of the clearing house, the producers have set aside funding for this. Collection points invoice PCSs this amount and the clearing house facilitates the payment.
- All actors in the domestic WEEE system must be accredited by the clearing house and actors must sign all of the relevant three agreements. The first agreement is signed between PCSs, municipalities and retailers with regards to take-back of WEEE. The second agreement is set between PCSs and municipalities with regards to collection of WEEE. Finally, operators must sign an agreement to strengthen the technical requirements for treatment of WEEE. The clearing house is equipped with the tools to ensure consistent operating conditions, safeguard equal and fair service provision, and enforce contingencies if actors fail to abide by the rules of the system.[5]

[5] BIPRO et al.

Relevant characteristics:

- There is an all-actors approach, meaning that all the actors in the WEEE chain have to report the quantities managed by them to the authorities.
- Compensation is paid to municipalities as an instrument to improve the performance of collection points. Municipalities are expected to play a proactive role.
- The clearing house recognises that each region within Italy creates different logistical difficulties. The matching algorithm ensures that all PCSs are required to operate in all regions of Italy. In effect, all PCSs are faced with the same logistical difficulties.

Further references:

- Clearing House website
- Accordo di Programma (consulted in June 2021)
- Condizioni Generale di Ritiro (consulted in June 2021)
- Convenzione Operativa (2019/2021)

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country. 6 PCSs out of the total 18 in the country operate with non-household WEEE only.

Slovenia

Financial clearing method between PCSs

Principle of matching
Financial clearing

Surface: 12% (compared to UK's)

Population: 3% (compared to UK's)

Number of PCSs*: 5/5

Mandatory handover to PCSs: Yes

WEEE in scope:

- All WEEE categories
- B2C + B2B
- All types of collection are included

Collection points participating in the system:

PCSs have private contracts with collection points. In total there are 210 municipalities, approximately 160 collection points, 1,500 retailers and 100 other collectors.

Set up purpose:

Financial clearing was set up to equilibrate the differences between a PCS's share of WEEE collected and its obligation based on its market share. It is a voluntary system, and not all PCSs participate all the time.

Matching methodology:

Responsibility calculation:

Producers' responsibility is calculated using POM data from January to June from the previous year. Each producer reports to the government by the end of April and the Government then shares this information to all PCSs at the end of May. PCSs will then calculate their market share using this dataset and the new responsibility is introduced in August.

Matching:

Not applicable as there is only financial clearing. Based on interviewee feedback, a new legislation for PCSs in Slovenia is expected to come into effect by 2023. However, at the time of writing, the interviewee cannot provide information on whether or how the legislation could affect financial clearing between PROs.

Post-matching:

Review (annual/periodic/fine tuning):

Annual: Data from PCSs (collection volumes) and producers (POM) is reported for the full previous year to calculate financial compensation. At the end of Q4 this data is ratified to see whether PCSs met their allocation obligation for the previous year. These calculations are implemented per category of WEEE.

Balancing:

PCSs that have deviated from their assigned collection obligations will enter bilateral negotiations to agree a compensation value. As these negotiations are bilateral, it is possible a PCS could enter up to four separate negotiations to correct deviations in collection per waste stream. The set compensation amount must be negotiated as all PCSs have their own auditors that in their financial report set varying prices for different types of WEEE. The basis of prices are the audited financial reports for all PCSs (each PCS chooses their auditors). Prices typically cover the operational costs (transport, recycling, some admin costs) for each category, and are charged on a € per tonne basis. However, there are agreed

rules on which costs are to be included/excluded. Once a compensation agreement has been established, it is signed by both PCSs and the amount cleared becomes part of a collection report published at the end of December.

Foundation Year: 2016	**Public/Private:** Private	**Revision of the methodology:** Potential revisions would depend on new legislation for PCSs in Slovenia which is expected to be in place by 2023.

Legal enforcement (voluntary/legal requirement):

PCSs set up the system and agreed to methodology. However, negotiation for financial clearing is not obligatory and there is no legal enforcement.

Financed by: N/A **Managed by:** PCSs	**Annual budget:** N/A	**Payment to collection points (Y/N):** Yes, but not obligatory. Each PCS calculates the gate fee paid their own way.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	EPA
Producers	*POM*	N/A as there is no clearing house in Slovenia	
PCSs			*POM and collected/year*
Clearing house			
Collection points	*Pick up request*		
Retailers			
Regional/local authority			
EPA	*Total POM*		
Waste management companies & treatment operators (AATFs).			

Other tasks of the clearing house: N/A

Relevant characteristics:

- An all-actors approach has been implemented together with mandatory handover since 2007.
- PCSs set up private contracts with LA for collection.
- A barrier to financial clearing is that negotiations between PCSs for a compensation agreement are not obligatory. Government enforcement that would make the clearing system fully functional is currently missing.

Further references: N/A

***** Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country.

France

OCAD3E

Principle of matching
Allocation of collection points

Surface: 264% (compared to UK's)

Population: nearly 100% (compared to UK's)

Number of PCSs*: 2/4

Mandatory handover to PCSs: Yes

WEEE in scope:

- All WEEE categories
- B2C
- Municipal collection

Collection points participating in the system:

4,500 municipal collection facilities

Set up purpose:

- To make efficient use of municipal collection points. Since they provide public service, the system had to be regulated.
- Coordination was required to service all collection points, avoid selective collection and regulate fees paid to municipalities.
- Needed a pool of resources to handle common points of interests and research topics among PCSs.

Matching methodology:

Responsibility calculation:

The proportional market share is calculated using the POM data per category for each producer within each PCS.

Matching allocation:

There are two PCSs involved in WEEE matching in the country. The collection obligations are split by their respective market shares. If one PCS's share of collection deviates from its market share, then the differences in tonnages of WEEE is corrected by (re-)allocating certain collection points with the equivalent tonnages of estimated WEEE arising.

The market share of each PCS is calculated to define how much needs to be collected from all types of collection channels. Amounts collected by PCSs from municipal collection points and other channels (e.g. retailers) are reported to the clearing house monthly. Collection and fulfilment of responsibility is tracked by WEEE streams (small appliances, screens, large appliances and cooling appliances). However, the balance is based on total tonnages of WEEE collected.

Post-matching:

Review (annual/periodic/fine tuning):

Collection rates are reported quarterly to the IT system of the clearing house to check for any deviations from the allocated share of obligation. Using the quarterly reported values, collection rates are projected for the current year of allocation and the following year. This information is used to inform whether balancing is needed and is discussed during quarterly meetings of the conciliation committee.

Balancing:

If a PCS's actual collected amount is lower than projected and therefore falls below the PCS's obligated share of collection, an adjustment of the balance is needed. This process occurs quarterly. There are two ways to adjust the balance:

1. A pool of collection points shared by all PCSs (approximately 1.5-2% of total balanced e-waste streams). The affected PCS will use this pool of points more than the others to achieve balance. This is a temporary solution, termed "fine-tuning".
2. If fine-tuning is insufficient to achieve balance, then long-term change is necessary. The conciliation committee (Comitée de Conciliation, made up of representatives from the Government and three municipality associations) adjusts PCSs' share of responsibility through reallocation of one or more collection points to correct PCSs' deviation from their set collection obligation.

If a PCS's actual collected amount is higher than projected and above the PCS's obligated share of collection, the balance will be carried over to the following compliance year.

Foundation Year: 2006	**Public/Private:** Private	**Revision of the methodology:** Planned change to tariffs paid to collection points in 2022.

Legal enforcement (voluntary/legal requirement):

It was an initiative of the PCSs pushed through by municipal representatives who wanted one contact point. Since 2020, a new regulation establishes that a clearing house must be in place when there are multiple PCSs.

Financed by: PCSs **Managed by:** OCAD3E is a separate private company – 2 people – tasks are subcontracted	**Annual budget:** Approx. €1 million, of which €200k-300k is spent on managing municipalities. The other 70% is spent on the technical side of OCAD3E. €30 million in fees are paid to municipalities through the clearing house.	**Payment to collection points (Y/N):** Yes, for collection facilities, charges, dedicated staff etc. Extra tariff is paid to enforce security measures to prevent theft.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Municipalities
Producers	*POM*		
PCSs		*POM & Collected*	
Clearing house			*Collected (for validation)*
Collection points		*Pick up requests*	*Collected*
Retailers			
Regional/local authority		*Send invoice*	
EPA			

Waste management companies & treatment operators (AATFs).	*WEEE received*		

Other tasks of the clearing house:

- Establishing agreements between LAs and shareholder PCSs. These contracts set out payments of tariffs to the municipality.
- Monitor the obligations of PCSs, including pick-up of WEEE (e.g. with logistic partners) and monthly data reporting to the clearing house on tonnages collected from all collection channels. OCAD3E asks municipalities to validate the collected amount quarterly (through its IT system). When validated, the invoice is made out by the municipality and fees are paid by OCAD3E.
- Ensure the consistency of messages to the consumers/citizens and establish a reference framework for waste prevention and eco-design.
- Establish and manage contractual/financial relations with LAs. It guarantees to the latter the continuity of the pickups and the payment of financial compensation for collection and communication.
- Coordinate general interest subjects regarding household WEEE: consumer survey, yearly national WEEE collection day, WEEE arising survey and common research projects.
- A collateral benefit of establishing the coordination centre (OCAD3E) is that OCAD3E was given a remit wider than administrating matching. OCAD3E facilitates activities that tackle issues such as theft and incorrect treatment of WEEE, by systematically engaging in legal actions for municipalities. For example, OCAD3E provides a dedicated lawyer, and since 2010, several hundred lawsuits have been argued, most of which ended in judgments (for recyclers/scrap dealers receiving stolen goods). OCAD3E also dealt with the first cases for forbidden cash purchasing in 2012.

Relevant characteristics:

- There is a compensation to municipalities not just for their services, but also for implementing extra measures to prevent theft.
- There are only two PCSs managing B2C equipment in the country.

Further references:

- Cahier de charges
- Ademe report 2019

*****Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country. In France, one PCS handles only B2B WEEE and hence it does not participate in the clearing house. One other PCS is only an adherent member to the clearing house (i.e. a customer of the clearing house, using the system as an intermediary between themselves and the LAs to receive collection requests).

Sweden

Swedish matching system

Principle of matching
Financial compensation

Surface: 185% (compared to UK's) **Population:** 15% (compared to UK's)	**Number of PCSs*:** 2/2	**Mandatory handover to PCSs:** No

WEEE in scope:

- All WEEE categories
- B2C
- Municipal collection
- Retail collection

Collection points participating in the system:

630 in total: 590 municipal collection points + 40 retail collection points

Set up purpose:

One of the two PCSs did not fulfil its responsibility, so the Government insisted the two PCSs must work together to fulfil responsibility equitably.

Matching:

Responsibility calculation:

The POM of the previous year is compared with collection figures of the previous year to calculate the market share.

Matching:

Not applicable as there is only financial clearing.

There is a pre-defined price list designed by the two PCSs of the country which is checked annually. The calculation of costs is based on previous collection tonnages and costs (although forecasts can be unreliable due to the price volatility of metals).

Post-matching:

Review (annual/periodic/fine tuning):

Clearing is done once a year around April for the previous year. Once all collection figures are available, they are reviewed by an auditor and compensation for deviations from collection obligations set by the matching methodology is calculated. Calculations are also sent to the EPA. The compensation is based on previously defined fixed costs (*WEEE weight x price is set for each WEEE category*). The amounts paid include costs related to collection, transport, communications, treatment and testing sites for the statistics required to maintain the system.

Foundation Year: 2008	**Public/Private:** Private	**Revision of the methodology:** Price list is checked annually
Legal enforcement (voluntary/legal requirement): EPA mandates cooperation and clearing of costs, but PCSs defined the methodology.		
Financed by: Cost of external auditor shared 50:50 by the PCSs. **Managed by:** PCSs	**Annual budget:** N/A	**Payment to collection points (Y/N):** Yes, PCSs pay for services provided, not for per tonne of WEEE.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers	*POM*	N/A as there is no clearing house in Sweden	
PCSs			
Clearing house			
Collection points	*Pick up requests*		
Retailers			
Regional/local authority			
EPA	*POM and collected*		
Waste management companies & treatment operators (AATFs).	*Collected*		

Other tasks of the clearing house: N/A since there is no clearing house.

Relevant characteristics:

- Potential impact to logistics: Municipal collection facility – PCS relationship is 1:1.
- No allocation of collection points. There are two PCSs in the country: one collects from all municipal collection points, the other collects mainly from retailers. One PCS is effectively buying service from the other because it lacks country-wide coverage.

Further references: N/A

Ireland

Producer Register Limited – not a clearing house but allows for financial clearing between PCSs

Principle of matching
Geographical split

Surface: 35% (compared to UK's)

Population: 7% (compared to UK's)

Number of PCSs*: 2/2

Mandatory handover to PCSs: Yes, for municipal and retailer collection sites

WEEE in scope:**

- All WEEE categories
- B2C
- Municipal and retail collection

Collection points participating in the system:

31 local authorities (all in the country) with multiple collection points and retailers

Set up purpose:

This clearing system allows for PCSs to increase operational and management efficiency. A protocol was determined by the two PCSs in the country and ratified by the Government. The Government required a coordination system and PCSs established the logistics.

Matching methodology:

Matching allocation:

Once the market share has been calculated for both PCSs, counties are assigned to them. The criteria used in this exercise include parameters such as population, land area, population density and distance from Dublin (as a proxy for logistical complexity).

Once a LA has been matched to a PCS, all WEEE categories (except for lamps) arising from all collection points within the area must be covered by that PCS, regardless of the collection point type (retailers or municipal collection points) or logistical complexity of the collection. If a retailer opens or closes collection points across the geographical boundary, the two PCSs will collaborate to arrive at an arrangement for collection and treatment.

Post-matching:

Review (annual/periodic/fine tuning):

Financial compensation (fine tuning): Tonnage is to be reconciled per category. A given year´s total POM, which is reported monthly by the producers, is compared with the given year´s total WEEE collection, which is reported annually by the PCSs. Each PCS submits the full operational costs of collection and treatment per tonne to an independent arbitrator. The arbitrator calculates the average between these values to give an average price per category. Reconciliation amounts are then calculated per category using these average prices, and total compensation is paid. The basis of the fine tuning is that only operational costs are included: logistics, collection points compensation and the treatment costs.

Balancing:

If, during the annual check, the collection rate has deviated more than 3% from the set market share (and for the preceding two years), a county will be reassigned to the other PCS. This is to correct the deviation for the coming year (some counties have more than one council or LA: there are 26 county councils, 3 city councils, and 2 city and county councils). The county that is chosen to be reassigned will need to meet the criteria that correspond to market share difference.

Foundation Year: 2007	**Public/Private:** Private	**Revision of the methodology:** Legal agreement between PCSs was revised in 2019.

Legal enforcement (voluntary/legal requirement):

The clearing system was set up by the PCSs, with documents ratified by the Government.

Financed by: PCSs (only cost of auditors) **Managed by:** PCSs	**Annual budget:** N/A	**Payment to collection points (Y/N):** Yes, but not to all, based on private agreements. PCSs also pay the same rebates to retailer collection points for access to WEEE.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house (limited role)	Regional/local authority
Producers		*POM*	
PCSs		*Cost & Collected*	
Clearing house			
Collection points	*Pick up requests*		
Retailers			
Regional/local authority			
EPA			
Waste management companies & treatment operators (AATFs).			

Other tasks of the clearing house:

The primary activity of the producer register relates to the administration of the national producer registration system (currently for WEEE, batteries and recently tyres), visible fee levels, and the management of the online reporting tool named 'Blackbox reporting system'. Producers in Ireland report monthly, in confidence, to Blackbox for the products they have supplied by weight/and or unit volume onto the Irish market. The allocation of the collection responsibility for household WEEE is based on the POM share of each PCS which is determined by the Blackbox (national register) data.

Relevant characteristics:

- Allocation of collection points/counties was determined initially and has not changed significantly over the years due to a relatively static POM share of the two PCSs.
- Relatively small surface area of country with only two PCSs.
- The two PCSs have aligned service standards for collection and treatment.
- Allows for long-term relationships between the PCSs and LAs because there have not been a lot of changes in the geographical split since the system was put in place.

Further references:

- The Producer Register Limited

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country.

** Only one PCS collects Lamps (WEEE Ireland), so it operates nationwide for this category.

Spain

Spanish Clearing system - OfiRaee

Principle of matching
Allocation of collection points and allocation of pick-up requests

Surface: 209% (compared to UK's) **Population:** 71% (compared to UK's)	**Number of PCSs*:** 8/11	**Mandatory handover to PCSs:** No

WEEE in scope:

- All WEEE categories
- B2C
- Collection points that have agreements with clearing house.

Collection points participating in the system:

1,485

Set up purpose:

Matching/allocation was a private initiative set up by PCSs. The clearing house named OfiRaee is recognised as a coordination body by the Government, and it does not have a legal entity. OfiRaee is a common and voluntary agreement among PCSs. Two private enterprises have been appointed by the PCSs to manage an online platform and provide technical assistance to users and PCSs.

Originally, the public authority suggested a clearing house as a coordination centre to manage collections from municipal collection points by PCSs, but this was not set as a legal obligation. The initiative was also pushed by the regional authorities as they see benefits in having a clearing house that would coordinate with municipalities and support the advertising campaigns in the regions (though not on national level since WEEE is within regional territories). The aim was to set up a central platform to gather collection data and assign collection facilities by market share of PCSs. Now, the clearing house also discusses other matters such as policy issues.

Matching methodology

Matching:

There are two different approaches to matching under the same WEEE system. The allocation of collection points is the method most used in Spain. An alternative method that allocates pick up requests is used less, typically upon agreement with authorities and if logistics allow. The latter is mostly used in the region of Catalonia but can also be used in other regions. For example, the allocation of collection points also works in the Catalonia region. In both approaches, each PCS's obligation is determined annually based on its market share.

- Allocation of pick-up requests: OfiRaee receives pick-up requests from collection points. These requests are processed through an algorithm that automatically allocates the collection service to the corresponding PCS(s) according to the market share of each PCS per category. Therefore, the PCS with the highest market share and lowest amounts collected will get most of the collection requests. The requests are assigned immediately, while collection tonnages are reported on a monthly basis (provided by the PCSs). This solution requires an agreement between the PCSs on the companies that manage the bins placed at collection points.
- Allocation of collection points: OfiRaee allocates collection points (and therefore the available tonnages arising from them) for each WEEE collection stream to PCSs according to their market share. PCSs finance (and organise) the collection and treatment of the WEEE from these collection points per WEEE stream (collection streams may range from 3 to 7). The different WEEE streams in one collection point may be allocated to the same or different PCSs, so the collection of WEEE in a collection point may be covered by one or more than one PCS. This is to allow the matched share of WEEE to more closely align with PCSs' potentially varied market shares across categories. PCSs provide the information of quantities collected to OfiRaee monthly.

Post-matching:

Balancing:

Based on the collection figures that are reported by the PCSs monthly, PCSs that have deviated from the collection obligations set by the matching methodology will enter remediation. This can be facilitated either by allocating some additional collection points with higher collection rates or by transferring WEEE from another PCS that has exceeded its collection responsibility (i.e. the transfer of a WEEE collection operation between affected PCSs).

Compensations are agreed individually between the PCSs and are not managed by OfiRaee, which only records the compensations when these enter into effect. In practice, bilateral agreements are made (between 2-3 PCSs, not all the PCSs) on the reallocation of collection points. Financial compensation is not used.

The method allocating pick-up requests does not consider compensations among the PCSs because it is assumed that the waste amounts are allocated in accordance with each PCS´s responsibility (market share).

Balancing is not applicable in the matching by pick-up approach.

Foundation Year: 2007	**Public/Private:** Private	**Revision of the methodology:** Allocation of collection points to be revised in 2021

Legal enforcement (voluntary/legal requirement):

Joining of OfiRaee is voluntary. Currently, the implementation of the recast of the WEEE Directive requires collective (with multiple members) and individual producer organisations to create an ''allocation office''. However, further legal background is pending and more work is expected before starting to set up this office.

Financed by: PCSs **Managed by:** Two separate companies are subcontracted (call centres and IT platform), which include three staff members.	**Annual budget:** €301k in 2020	**Payment to collection points (Y/N):** Yes. Compensation by collection points varies based on the level of sorting the WEEE collected by the municipalities requires.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers	*POM- quarterly*		
PCSs		*POM (annually) & Collected (monthly)*	
Clearing house	*Market share Assignment of CPs*		
Collection points		*Pick up request*	
Retailers			
Regional/local authority			
EPA			
Waste management companies & treatment operators (AATFs).	*Collection*		

Other tasks of the clearing house:

- Act as the platform for participating PCSs to discuss WEEE related issues e.g. policy matters.
- Supervise the audits.
- Manage e-platform dealing with collection requests of WEEE in municipalities having signed a regional agreement.

Relevant characteristics:

- One system, two approaches.
- PCSs that are not involved in the OfiRAEE simply collect WEEE to comply. They do not report data or set up agreements via OfiRAEE. These PCSs are still required to meet the 65% of WEEE POM target and may be penalised if they do not meet these targets.
- As the system is voluntary for all parties, some agreements between collection points and PCSs will contain only one actor that is a member of the clearing house.

Further references:

- OfiRaee

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country.

Germany

EAR - Stiftung Elektro-Altgeräte Register

Principle of matching

Allocation of municipal pick-up requests

Surface: 147% (compared to UK's)

Population: 130% (compared to UK's)

Number of PCSs*: 0

Mandatory handover to PCSs: No

WEEE in scope:

- All WEEE categories (and batteries)
- B2C & B2B separately reported
- Municipal collection points use the system
- Retailers, producer's collection points and treatment partners also report

Collection points participating in the system:

1,896 municipal collection points, 8,123 retail collection points, 3,335 producers collection points and 1,296 individual take back organisations.

Set up purpose:

Clearing house was set up as a neutral and independent entity to avoid conflicts of interest in terms of WEEE, recycling, logistics, etc. The registration of EEE producers or authorised representatives ensures that the producers are taking responsibility for the WEEE arising, especially the responsibility for recycling and disposing of these according to the WEEE legislation (ElektroG). WEEE from private households is collected in containers provided by the örE (public waste disposal authorities). Most producers manage their extended producer responsibility directly, without the support of a PCS.

Matching methodology:

Responsibility calculation:

The producer responsibility is calculated by the clearing house based on POM reported monthly per sub-category. All B2C WEEE that is collected via the municipalities in Germany is allocated via Stiftung EAR to an obligated producer to take the WEEE back, recycle and report it.

Matching:

Producers or authorised representatives register to Stiftung EAR. WEEE is collected in six different groups in standard containers at the collection sites. The different groups and their minimum collection volumes are as follows:

- Group 1: Heat exchangers – $30m^3$
- Group 2: Screens, monitors and devices containing screens with a surface area of more than 100 cm^2 - $30m^3$
- Group 3: Lamps -$3m^3$
- Group 4: Large appliances - $30m^3$ (night storage heaters – $5m^3$)
- Group 5: Small and small information and telecommunications equipment – $30m^3$
- Group 6: Photovoltaic modules – $2.5m^3$

(Battery-operated equipment of groups 2, 4 and 5 have a minimum collection volume of $5m^3$)

When a container is full, the collection site reports this to the clearing house. The clearing house then indicates, using a calculation method based on market share and collection data, which of the EEE producers or their authorised representatives are obligated to pick up the container and set up a new, empty container for WEEE from private households (B2C equipment).

An IT system runs the algorithm to identify the producer that needs to pick up the request. The clearing house issues the given producer a pick up and set up order, from which the producer can see where, when and which container needs to be picked up and replaced with an equivalent empty container. Municipalities can legally opt-out of a waste category for two years. In this case they are responsible for the proper recycling and treatment of the B2C WEEE they collect, and for reporting tonnages to the clearing house.

There is continuous monitoring and revision of the system by Stiftung EAR.

Post-matching:

Review (annual/periodic/fine tuning):

Monthly surplus/deficiency are carried forward and balanced.

Balancing:

The above process continues every month. There is no yearly settlement.

Foundation Year: 2004	**Public/Private:** EAR was founded by producers and producer associations, but was given sovereign rights resulting from the ElektroG (Elektro und Elektronikgerätegesetz - German implementation of WEEE Directive). As a result, it now also acts as an authority.	**Revision of the methodology:** Continuous system monitoring and revision.
Legal enforcement (voluntary/legal requirement): A voluntary initiative by producers and producer associations which was approved by law later on.		
Financed by: Producers **Managed by:** Separate entity with 35 employees	**Annual budget:** Approximately €8 million (including WEEE and batteries)	**Payment to collection points (Y/N):** No

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers		*B2C-EEE POM monthly + B2C WEEE collected B2B POM and collected yearly*	
PCSs			
Clearing house			
Collection points		*Request pick-up*	
Retailers		*B2C collected, yearly*	
Regional/local authority		*B2C-WEEE, in case they opt-out for, monthly*	
EPA			
Waste management companies & treatment operators (AATFs).		*Collected yearly*	

Other tasks of the clearing house:

- Binding decisions regarding the scope of the law, information and awareness raising campaign for consumers.

Relevant characteristics:

There are almost no PCSs operating in the market. Most producers directly manage their extended producer responsibility obligations. Some entities (e.g. PV Cycle) organise and carry out individual WEEE take-backs for their producers to reduce the individual take-back obligation of these producers.

Further references:

- Stiftung EAR home page
- EAR portal
- Calculation method

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country. See relevant characteristics for more information.

Austria

Elektroaltgeräte Koordinierungsstelle Austria GmbH – EAK (Austrian Coordination Body for Waste Electrical and Electronic Equipment)

Principle of matching
Allocation of pick-up requests

Surface: 35% (compared to UK's)

Population: 13% (compared to UK's)

Number of PCSs*: 5/5

Mandatory handover to PCSs: No

WEEE in scope:

- All WEEE categories
- B2C
- Municipal collection

Collection points participating in the system:

In 2019, a total of 169 collection points for WEEE and 132 collection points for batteries used the collection coordination 1,431 times.

The country has approximately 2,000 collection points, including LAs, sites set up by producers and 100 consolidation points (that also accept WEEE from retailers).

Set up purpose:

After the implementation of the first WEEE Directive, the Ministry of Environment decided it was necessary to create a body that would coordinate the collection of WEEE to meet the national collection target. In the end only a minor amount of the total collected waste is going through the clearing house.

Matching methodology:

Matching:

PCSs set up private contracts with collection points, with 97% of the WEEE collected arriving through these contracts. Only 3% of the WEEE collection obligation of the PCSs in Austria is coordinated by the clearing house. PCSs must report monthly the collection tonnages to the clearing house, so the clearing house can calculate the total collected tonnages per category every month. The clearing house then calculates the weight percentages for each WEEE category and also the obligation rate for each PCS. This allows the clearing house to track whether the PCSs deviate from the collection obligation set by the matching methodology. Market shares are checked every quarter. Municipalities without private contracts send collection requests to the IT platform, and PCSs can decide in 24 hours whether to offer to take the pick-up request for free. If there is no offer for a pick-up order, then the PCS with a higher responsibility will collect the WEEE.

PCSs must pay for the whole infrastructure (bins, etc.) required at municipal collection points. There is a flat rate calculated for covering infrastructure costs. If municipalities use the pick-up collection, they get this flat rate. The fee depends on the type of category. With direct contracts, €/tonne is paid to the municipality by the PCSs. Collection points (municipalities) can decide whether they want to use a pick up order (i.e. joining the clearing house) and get the flat rate (e.g. because they have very low volumes), or municipalities can get a fee per tonne if they sign a direct agreement with a PCS.

Post-matching:

Post-matching balancing process:

If there is an increase in the responsibility of the PCS, the agreements with the waste collectors will change accordingly. Most PCSs subcontract the same companies to collect WEEE, so it is relatively easy

to change the agreements and report the collected amounts to PCS ''A'' instead of PCS "B" (there are approximately 25-30 collecting companies).

Annual re-computations are to be completed by end of April. This serves to compensate for seasonal fluctuations of the quantities picked up quarterly and to prevent potential inequalities resulting from the obligations of the PCSs.

Foundation Year: 2005	**Public/Private:** Private company – owned by 4 public companies	**Revision of the methodology:** No

Legal enforcement (voluntary/legal requirement):

It is a legal requirement laid down in the Waste Management Act (AWG 2002), WEEE Ordinance, Battery Regulation.

Financed by: WEEE PCSs + Battery PCSs **Managed by:** Separate entity with six employees.	**Annual budget:** €800k - 900k/year	**Payment to collection points (Y/N):** Yes, flat rate per WEEE category for covering infrastructure costs.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers	*POM/month*		
PCSs		*POM & collected /month*	
Clearing house			
Collection points		*Pick-up request*	
Retailers			
Regional/local authority			
EPA			
Waste management companies & treatment operators (AATFs).		*Actual amount of WEEE collected*	

Other tasks of the clearing house:

- Public relations - nationwide uniform public relations work for raising awareness in society about the prevention or proper disposal of WEEE and waste batteries.
- Paying out compensation for costs in accordance with Section 19 (3) of the WEEE Ordinance and Section 20 (3) of the Battery Regulation to ensure uniform information for final consumers by the municipalities or municipal associations in relation to the number of inhabitants.
- Preparation of annual reporting to the Ministry of the Environment or to the European Commission. The report includes the weight of WEEE and waste batteries placed on the market, as well as all that of WEEE and waste batteries collected or re-used or treated in Austria.

Relevant characteristics:

- An all-actors approach is implemented.
- Clearing house is only used for 3% of the total collected amount.
- The logistics and treatment companies running collection services play a relevant role. Changes in the collection responsibility of a PCS become effective through changes in the contracts between the PCS and waste management company that is usually contracted by the other PCSs in the country.

Further references:

- Coordinating body (eak-austria.at)
- EAK annual report (2019)

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country.

Denmark

Danish Producer Responsibility System - DPA-System

Principle of matching
Allocation of collection points

Surface: 18% (compared to UK's)

Population: 9% (compared to UK's)

Number of PCSs*: 5/5 + individual systems

Mandatory handover to PCSs: Yes

WEEE in scope:

- All WEEE categories
- B2C (B2B is reported to clearing house but is not included in allocation)
- Municipal collection

Collection points participating in the system:

397 municipal collection sites

Set up purpose:

The Danish Producer Responsibility system (DPA-System) was set up by the public authorities, under the Environmental Protection Act (the Danish implementation of the WEEE Directive), to ensure high quality data collection which could produce statistics to inform on the EU WEEE Directive targets. The system also, using a well-defined algorithm, coordinates the equitable allocation of municipalities to PCSs. The organisation is privately financed but regulated by the Ministry of Environment and the annual budgets must be approved by the EPA.

Matching methodology:

Responsibility calculation:

PCSs report POM of producers and collection on a yearly basis to the DPA-System. Every year, the DPA-System calculates the WEEE quantity that producers or PCSs are obliged to collect from households based on their market shares.

The DPA-System calculates an expected quantity of collected WEEE and waste batteries and accumulators (BAT). This is carried out by dividing the average of the municipality's total collected

quantity per WEEE stream for the past three years with the average number of inhabitants for the same three years. Each municipality thereby gets an estimated quantity of WEEE for allocation.

Matching allocation**:**

Once the responsibility has been calculated, the DPA-System allocates the different geographic areas and associated collection sites to the producers in proportion to their market share for each fraction. Areas may be one or more neighbouring municipalities (minimum geographic unit allocated). There is only one assigned PCS/producer per stream in each municipality, and each stream of WEEE within a municipality is seen as a single entity. The allocation of the different municipalities takes place per stream.

In view of optimising logistics, producers or PCSs may agree among themselves to take over or surrender each other's collection sites within the same stream, in the consultation period for the subsequent year's allocation. Such agreements must be notified to DPA-System, and will be incorporated in the decision on the subsequent year's allocation before publication on 1 June.

Post-matching:

Balancing:

If a producer or PCS has deviated from its allocated collection responsibility, the corresponding quantity will either be added to or subtracted from the subsequent year's allocation. Every year, the previous year's collection excess/deficit is reset to zero before a new excess/deficit for the coming period is calculated, based on the present market share of the reporting year. The reason for this resetting to zero is that if a PCS was allocated less than the market share due to excess collection the year before, this quantity should not be included as a collection deficit in the present year.

Foundation Year: 2005	**Public/Private:** Private	**Revision of the methodology:** N/A

Legal enforcement (voluntary/legal requirement):

In the Danish interpretation of the WEEE Directive Implementation Act, the Ministry defined the purpose and functions of the DPA-System. The DPA-System is also regulated by the Government through this law. From 2009 ELV and batteries were also included within the scope.

Financed by: PCSs **Managed by:** Separate non-profit organisation with 20 - 30 members of staff.	**Annual budget:** No information obtained.	**Payment to collection points (Y/N):** No

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers	*POM*		
PCSs		*POM & Collected*	*Collected (upon request)*
Clearing house	*Informs PCS of market share*		
Collection points		*Register at clearing house*	
Retailers		*Collected*	
Regional/local authority			
EPA			
Waste management companies & treatment operators (AATFs).			

Other tasks of the clearing house:

Reports to EPA on the amounts collected.

Relevant characteristics:

- Relatively small country with islands.
- Mandatory handover and all-actors approach both implemented.
- LAs must establish and pay all costs for establishment and operation of municipal collection sites and separating WEEE into streams. Municipalities are proactive in establishing communication campaigns with the public. These can be done in collaboration with collective PCSs or independently as part of the state-funded budget for public services.

Further references:

- DPA-System Allocation Scheme (WEEE + BAT)
- https://www.dpa-system.dk/en/DPA

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country.

Illinois (United States)

Illinois clearing house – ERRO (Electronics Recycling Representative Organisation)

Principle of matching
Allocation of collection points

Surface: 62% (compared to UK's)

Population: 19% (compared to UK's)

Number of PCSs*: 6/6

Mandatory handover to PCSs:** No

WEEE in scope:

B2C, selected categories of IT/Consumer electronics:

- Computers/small scale servers
- Computer monitors
- TVs
- Printers/fax machines/scanners
- DVD/VCR/DVRs
- Games consoles
- Cable and satellite receivers
- Keyboards/mice/portable music players

Municipal collection points. Private sources of collection arranged by PCSs (e.g. retailer take-back) only counted if reported at the beginning of the year.

Collection points participating in the system:

399 municipal collection points (85% of the population of Illinois could use a collection point or event in 2019)

Set up purpose:

The previous methodology for matching, based on a 2007-08 law, used a tonnage-based goal requirement for producers that resulted in some collection points not being consistently served (e.g. producers would stop collecting WEEE when their target was reached). Some actors felt the goal was set incorrectly because the average weight of new EEE POM tends to decrease. Therefore, if goals were set based on tonnage of POM this would not equitably balance with products at end of life which are heavier. Counties and producers aimed at a matching system that did not include a weight-based collection goal. It was agreed to use a clearing house, so that all WEEE arising from the system would be collected by producers or their PCSs in an equitable way to ensure all producers were paying their fair share.

The new system removed collection targets for producers. Since the targets are linked to the weights of EEE POM in previous years, this also prevents fluctuations in weight-based collection targets due to weight changes from product designs.

Matching methodology:

<u>Responsibility calculation:</u>

The responsibility is set by calculating the adjusted total proportional responsibility per producer. Firstly, the percentage of each category of POM WEEE is calculated using the previous year's data. Then the percentage of each category of POM WEEE from two years prior is calculated from EPA data to incorporate time equality into the method, to smooth out fluctuations in producer sales. These two values are then multiplied together to calculate the average producer responsibility (per producer per category). PCSs responsibility is the combined responsibility of each member producer.

<u>Matching allocation:</u>

Allocation of collection for the counties is based on obligation percentages of PCSs and estimated collected tonnages of WEEE by category. Obligation percentage is calculated as:

> *Market share per WEEE category of a producer (from the previous year) x the share of WEEE collected per category (from the previous two years).*

The purpose of modifying the market share by the historical share of collection is to reflect that some producers today may be responsible for the collection of certain WEEE categories that are now rarely disposed of (e.g. cathode ray tube in TVs). All of these obligations per WEEE category are summed up to arrive at the overall percentage for each producer, and a PCS's obligation is the summed total of all of its producer members' obligation percentages.

In most cases (except in Cook County - the largest in terms of population), the assigned PCSs must service a minimum number of collection points within a county, and they are free to choose them. Counties can opt in and out every year from participating in the manufacturer programme. When they opt in, at the allocation they are asked to state which PCSs or recyclers they prefer to work with. PCSs are also asked to indicate their preferences upon the yearly registration regarding which counties they want to work with and whether they want to include other collection sources based on private agreements (e.g. retailer take-back). All these preferences are also considered at the allocation. Any private agreements are offset against the PCSs obligation before the PCS is assigned a county. Existing relationships before the setting up of the clearing house are also considered at allocation. The burden of collecting from small and far-away places is distributed evenly between PCSs.

In summary, there is no strict algorithm, but the allocation is based on the stakeholder preferences and relationships, and fairness. Retail points are not included, as PCSs have private agreements with them.

Post-matching:

Review (annual/periodic/fine tuning):

Periodic: PCSs report the quantities of collected WEEE per category quarterly to the clearing house. The clearing house then calculates and informs each PCS of their rate of collection against their set obligation. This allows the PCSs to take action to correct these deviations (for example by working with the counties to organise collection events. At the end of Q4, a final report stating the PCSs total collection against their obligation is published. Counties may also be re-assigned to PROs during the year if significant over collection is identified.

Balancing:

Once the final collections have been reported, the PCSs have 2 weeks to trade pounds (weight) credits in order to balance against the set obligations and level out deviations. If a PCS has deviated from its collection obligation set by the matching methodology, they may either trade these credits or roll over the deviated volume to the following recalculation, which is 2 years subsequent to the fact, due to time constraints of reporting. A PCS is only permitted to roll across a limited quantity of credits (up to 20% of the obligation) to enable trading of credits. There are no penalties set for producers that are unable to meet their set obligation.

Foundation Year: 2018	**Public/Private:** Private	**Revision of the methodology:** Yes, currently producers with an obligation of below 1% are allowed to set up individual take-back schemes. Threshold soon to be increased to 3%.

Legal enforcement (voluntary/legal requirement):

The law was initiated by the State; industry non-profit organizations began tendering in February 2018 for a clearing house administrator, and NCER was appointed. In late June 2018 a bill was passed to establish anti-trust protections and a methodology for allocating responsibility amongst producers for meeting Consumers Electronics Recycling Act requirements, which allowed the clearing house to move forward

Financed by:

- Initial funding for clearing house administrator from CTA (Consumer Technology Association).
- Operational costs financed by producers´ fees.

Managed by:

ERRO – separate entity

Annual budget:

$200k-250k for the operation of the clearing house

Payment to collection points (Y/N): No

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers		*POM*	*Have to register with EPA if want to be part of the e-waste plan*
PCSs		*Quarterly, collected amounts from collection points and other sources*	
Clearing house	*Quarterly confirm the collected amount against their obligation*		*Annual report to EPA*
Collection points			*Have to register with EPA if want to be part of the e-waste plan*
Retailers			*Cannot sell unregistered brands*
Regional/local authority			
EPA		*Approves plan yearly*	
Waste management companies & treatment operators (AATFs).			*Have to register with EPA if want to be part of the e-waste plan*

Other tasks of the clearing house:

- Assigning of opt-in counties to PCSs annually.
- Sets the number of collection sites per county or territory. Calculation of the number of sites/population density is a duty of the clearing house .

Relevant characteristics:

- Potential effect on logistics: One PCS services all municipal collection facilities within a county.
- PCSs can also choose to collect from retail collection points / help to host collection events within their assigned county/territory.
- Counties join the programme on a voluntary basis. A municipality accepted in the system must have more than 1 million residents. Municipalities that opt in are also required to establish a minimum number of permanent collection sites, or to organise collection events.
- A producer may join multiple PCSs and decide how to split its total responsibility between the PCSs accordingly.

Further references:

- 2019 Registered Producers
- ERRO Producer Clearing House Program Plan 2020
- IEPA 2019 E-Waste Summary Collection Report
- NCERE Waste Presentation Dec2018 JLinnell
- ERROManufacturerClearinghouseProgramPlan2020.pdf

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the territory.

** In Illinois, a PCS is known as a 'group plan' (*for the purpose of consistency between interviews the term PCSs will be used in this report*). These entities can be profit or non-profit, however at the moment of writing this report all are for-profit entities. A group plan is managed by either a recycler or a management company that hires recyclers. Group plans not only serve collection points that opt into the program, but also organise collection events.

Norway

Financial clearing between PCSs

Principle of matching
Financial clearing

Surface: 159% (compared to UK's)

Population: 8% (compared to UK's)

Number of PCSs*: 4/4

Mandatory handover to PCSs: No – but almost all collection points hand over to PCSs

WEEE in scope:

- All WEEE categories
- B2C +B2B

Collection from all sources

Collection points participating in the system:

>2500 - 3000** (including all types of collection points, municipal collection points, retailers, other)

Set up purpose:

Clearing was pushed by both government and industry to avoid PCSs meeting their targets early in the year and stopping collecting (which happened in 2012). Norsirk, one of the country's PCSs, initiated the discussion on the interpretation of the Waste Regulation. After discussions with the other PCSs, a code of conduct that includes the rules of balancing was agreed. Currently, the environment agency has access to general information on the process but is not directly involved.

Matching methodology:

Collection from each of the country's six regions is based on free competition among PCSs. The collection target is calculated by region considering the population and divided among the PCSs. The collection obligation of a PCS considers the market share of the PCS and the deviations from the set collection obligation of the PCS in the previous year. Municipalities issue tenders for PCSs to service their sites (but municipalities in one region or more regions may cooperate in tenders), so PCSs take on the costs of collection and storage and cover some additional costs.

There is an agreement that all PCSs should cover their obligations in all regions and there is a 3-year period to reach the total target. The current 3-year period is ending in 2021, meaning that a particular PCS has to collect its share of WEEE of the total collected in the period including the year of 2019-2020-2021. The current 3-year target is set for 90% of assigned obligation for the POM for the previous three years. There is also a yearly collection target set for PCSs. The current yearly collection target is 75% of assigned obligation.

PCSs can choose to apply financial clearing at the end of the year or wait until the end of the 3-year period. Which option to use is negotiated by all PCSs together. At the end of each year (or at the end of the 3-year period), there is buying/selling of waste tonnages to balance within all WEEE categories (1 to 6).

The principle of the methodology allows that, for example, only one PCS collects WEEE from a collection point in a remote region of Norway instead of all four PCSs. The one PCS can then sell the WEEE collected to the other three.

Post-matching:

<u>Balancing</u>**:**

Balancing is done based on final/approved figures by the EPA. It is a process of negotiation by WEEE category between the PCSs on a 1-to-1 basis. PCSs offer fixed costs for a given region and category.

There is trade-off among PCSs for different WEEE categories since collections from some regions (e.g. North) are more expensive. PCSs tend to agree to negotiate for balancing to meet the annual targets.

Foundation year: 2013	**Public/private:** Private	**Revision of the methodology:** Fees paid to collection points may be adjusted to account for inflation/increases in costs (e.g. with wages/transport costs).

Legal enforcement (voluntary/legal requirement):

Obligation for clearing is included in the Waste Regulation but the rules of implementation are set down by separate agreement/code of conduct between PCSs.

Financed by: N/A **Managed by:** N/A	**Annual budget:** N/A	**Payment to collection points (Y/N):** Yes, paid per weight and per category. The amount paid is agreed by all PCSs and was fixed in 2017.

User Reporting:

	Reporting and monitoring		
From/To	PCSs	Clearing house	Regional/local authority
Producers	*POM*		
PCSs			*Tonnages collected*
Clearing house			
Collection points	*Pick up requests*		
Retailers			
Regional/local authority			
EPA			
Waste management companies & treatment operators (AATFs).			

Other tasks of the clearing house: N/A

Relevant characteristics:

- Large areas with low population density.
- Reduced number of PCSs.
- Collection contracts are at least three years but can be up to six or eight years.

Further references:

- Waste Regulations - Norwegian Environment Agency (miljodirektoratet.no)
- https://eereg-arkiv.miljodirektoratet.no/ShowHTML.aspx?file=Statistikk.htm

***** Number of WEEE PCSs participating in the clearing house from the total number of WEEE PCSs in the country.

****** Number of collection points operated by one PCS; it is to assume that the total number of collection points participating in the clearing system is higher.

United Kingdom

Producer Balancing System (PBS)

Principle of matching

Short/Medium term allocated contracts and cost-sharing of orphaned WEEE

Surface: 100% (compared to UK's)	**Number of PRO*s:** 10/28	**Mandatory handover to PROs:** No

WEEE in scope:

- All WEEE categories: large domestic appliances (LDA), small mixed WEEE, cooling, display, photovoltaic panels and lamps
- B2C
- Orphaned LA DCFs

Collection points participating in the system since 2016:

856

Set up purpose:

A mandatory system was introduced to manage orphaned LA WEEE (i.e. streams that are not covered by private contracts with PCSs). This system allows LAs situated in commercially unattractive, remote locations to have some or all of their WEEE streams collected by a PCS. The costs are split between PCS members of the PBS by market share.

Methodology for allocating PBS contracts:

When a PCS receives a Regulation 34 request, it may decide not to fulfil the request itself but to refer it to the PBS instead. In this case, the LA submits a written Regulation 34 service request to the PCS, who in turn may choose to pass this to the PBS through an online system including information on WEEE streams, site and collection contract length. Then, there is a multi-stage process which firstly allows another PCS to take on the collection. Then if no PCS comes forward, an anonymous bidding process over three weeks will be undertaken to determine which PCS wins the bid. The bidding process is a reverse-auction and the lowest-cost bidding PCS wins. If there are no bids, the PBS operator uses a randomly generated list to allocate collection to a single PBS member. The incumbent provider is informed of winning/allocated PCS. The incumbent PCS services any collection requirements within a three-week transition period. The resultant evidence notes are allocated to PCSs based on market share. Bids are stream-specific and, in practice, there is typically more than one bid submitted by PCSs where multiple streams are available. Normally, the winner is an established organisation within the area and able to benefit from economies of scale.

Financial and evidence management process:

There is a reconciliation process at the end of each quarter, and it typically takes a month for calculations and payments. On a monthly or quarterly basis, PCSs input data on the tonnage and cost of collected WEEE from every collection.

When the WEEE has been collected from the LAs and taken to the AATF (treatment site), the AATF provides an evidence note. The evidence note states the tonnage per category of WEEE received. This evidence is submitted to the PBS administrator. The administrator validates the PCS´s collection data against the AATF evidence note for each stream. Any discrepancies will be raised by the administrator with the PCS, who will be responsible for resolving them with the treating AATF.

<table>
<tr><td colspan="3">The PBS administrator then calculates the evidence share and cost per PBS member. First, the total tonnage of evidence issued for each category is calculated. Then, the total cost per stream collected is calculated. This yields the total transaction costs per stream. There is a nominal management fee charged by the operator per request and per evidence note. This cost is distributed on the same market share approach.

Based on the market share of each member PCS in each stream, the quantity of evidence notes to be financed by each PCS by stream is calculated for a given compliance year, and an invoice (net charge/rebate for interim collections) is raised to each PCS on a quarterly basis.

Once funds have been received from each PCS, the PBS administrator will transfer the evidence to the Settlement Centre Account[6] for the categories and quantities detailed in the invoice, such that the evidence is claimed by a PCS.</td></tr>
<tr><td>Foundation Year: 2016</td><td>Public/Private:
Public</td><td>Revision of the methodology:
Reviewed every three years by Defra</td></tr>
<tr><td colspan="3">Legal enforcement (voluntary/legal requirement):

Industry-led voluntary initiative that turned mandatory in 2019.</td></tr>
<tr><td>Financed by: PCSs through an annual registration fee which includes the fees for evidence notes per category, allocated to PCSs based on market share

Managed by: Anthesis: administrates PBS; WSF Ltd: operates PBS</td><td>Annual budget:
• £5k admin fee
• £2.5k external audit
• Legal costs</td><td>Payment to collection points (Y/N):
Not through the PBS system.</td></tr>
</table>

[6] The WEEE Settlement Centre is an initiative funded by the Government Department for Business Innovation & Skills (DBIS). The primary function of the Settlement Centre is to record evidence of WEEE treatment and to allow issuance and holding of Evidence Notes to be monitored (https://www.weee-sc.org.uk/)

User Reporting:

	Reporting and monitoring		
From/To	PCSs	PBS administrator	Regional/local authority
Producers	*POM*		
PCSs		*Tonnages collected and corresponding costs (for quarterly cost reconciliation). Uploading information on LAs into the PBS system if required.*	
PBS administrator			
Collection points		*Service request*	
Retailers			
Regional/local authority	*Regulation 34*		
EPA		*PROs market share*	
Waste management companies & treatment operators (AATFs).		*Provides Evidence note*	

Other tasks of the clearing house: N/A

Relevant characteristics:

- There are many competing WEEE PCSs operating in the market. WEEE collection by PCSs is mostly based on private contracts. The PBS is used for a small fraction of the total WEEE collected.
- Retailer collection points are excluded from the PBS.

Further references:

- Proposal to operate mandatory PBS
- WEEE update: Government confirm mandatory Producer Balancing System (PBS) method
- Electrical and Electronic Equipment: Ingredients for Successful Extended Producer Responsibility

*Number of WEEE PCSs participating in the clearing house from the total number of WEEE PROs in the country.

Commentary on adapting the PBS into a matching system

Upon comparing the PBS methodology against the principles of matching, the PBS was deemed unfit as the basis for a UK matching system. A core principle of matching is that every PCS should participate in physical collection to meet its obligation. The reverse-bidding methodology of the PBS was devised for PCSs to collectively address their obligation towards LA DCFs under Regulation 34. The methodology is primarily one for cost-sharing, and not one for allocating physical responsibility. The risk of adopting a reverse-bidding methodology for matching is that only a handful of the PCSs may bid competitively to respond to collection requests all over the UK, while the rest of the PCSs could just finance the collection afterwards. This scenario would go against the goal of creating a level playing field amongst PCSs. Furthermore, under this scneario, all PCSs would be charged the same price (based on the winning bid) for collection of any given WEEE stream across the UK. Given that the cost of collection is a major cost centre for PCSs, this scenario risks creating significant cost commonality and further work would be necessary to understand its implication on competition law.

One way of assigning physical responsibility using the reverse-bidding methodology could be to allow PCSs to bid for LA tenders. Indeed, one UK PCS recalled that this was discussed as a possibility during the planning phase of the PBS but it never materialised. A major limitation would be that public tendering is not driven by costs, but rather focused on quality of service and include other requirements such as bespoke arrangements (as will be elaborated in Section 5.1). Therefore, the PBS methodology is unsuitable for contract-bidding.

Lastly, the PBS methodology would not be able to deliver on other benefits offered by matching. For example, a reverse-bidding methodology could not enable long-term stability in the wider system. It could also lead to even more fragmentation of the DCFs if bidding occurred for each WEEE stream, making it difficult for the relevant actors to together improve the efficiency of collection and lessen the environmental impact of transporting WEEE.

5.2 Benefits, success factors, notable barriers and limitations of matching

During the interviews, stakeholders were asked what they felt had been the benefits or limitations of matching, and to share their experiences of the success factors and barriers to the system. This section outlines this stakeholder feedback on existing matching systems which provides learnings for a potential UK implementation.

Throughout the interviews, no stakeholder was able to provide any data to quantitatively demonstrate how matching improves or hinders WEEE system performance (such as collection quantity, quality, efficiency, costs, or environmental impacts). This is because all systems that involve matching of pick-up requests or collection points have been in place since the beginning of the WEEE Directive implementation in Europe, or the Consumer Electronics Recycling Act[7] in the case of Illinois. There is no 'pre-matching' reference scenario to compare against. Therefore, it is important to note that the benefits and limitations cited below are qualitative and from the perspective of the PCSs.

Table 3 summarises the benefits of matching observed by the stakeholders interviewed.

Table 3 The benefits of matching

Level playing field for PCSs The matching system sets the ground rules for all PCSs in a territory to deliver services to the same quality requirements and work with similar level of logistical complexity (i.e. no selective collection of only revenue-generating streams, no avoidance of collecting in costly areas). For example, in Italy the algorithm ensures that all PCSs work across the country and with the same logistical complexity, whilst also allocating all PCSs access to their fair share of obligated WEEE. Similarly in France, it is mandatory for PCSs to serve all collection points, thereby mitigating selective collection. In Austria, the system enables all municipalities to be covered for collection, creating a "safety net" for orphaned WEEE that is not covered by bilateral agreements with PCSs. Matching alleviates intense competition for access to WEEE. PCSs can still stay competitive by working towards more efficient operations and providing valuable services for their producer members. In Italy's case, this contributed to the reduction of visible fee and enabled PCSs to focus their efforts on improving their services.
Wide coverage of extended producer responsibility A matching system, when including at least all LA DCFs in the territory, would ensure that the collection service is provided territory-wide. This approach avoids creating orphan LA DCFs. Compliance of the PCSs can also be centrally monitored by the clearing house.
Efficient and harmonised approach In many territories, the remit of the clearing house extends to running various initiatives such as projects and communication campaigns at a territory level that are supported by all PCSs. This approach pools resources from individual PCSs, allowing funds and efforts to be spent more efficiently and with wider influence. Depending on each territory's context, the role of a clearing house can include aspects such as: • Facilitating agreements to allocate collection responsibilities among PCSs.

[7] '415 ILCS 151/ Consumer Electronics Recycling Act' accessed 15 October 2021, https://www.ilga.gov/legislation/ilcs/ilcs5.asp?ActID=3816&ChapterID=36.

- Managing other actors.
- Designing strategies for expanding and improving the collection network, such as improving existing collection points or creating incentives for new collectors to be part of the national collection network.
- Funding R&D e.g. running studies on WEEE flows, technical best practice development, etc.
- Coordinating national and local communications campaigns for an efficient use of resources.
- Support enforcement planning and enforcement initiatives.

Some stakeholders raised that a clearing house brought benefit beyond administering the matching system, by serving as a common platform for stakeholders across the sectors. For example, the clearing house in France allows PCSs to share the cost burden of projects of common interest, such as on topics of ecodesign or flame retardants. The Spanish interviewees also highlighted that the clearing house enables discussing issues of common interest and facilitates establishing common policies to improve the management of WEEE.

It is recognised that in the UK context, some of the functions described above are already being delivered by organisations such as the environment regulators and various cross-sectoral stakeholder groups. Therefore, a UK clearing house may not need to have an elaborate role.

Improved data quality and transparency

A matching system requires high-quality and up-to-date data. Therefore, the set up of a matching system usually entails the set-up of a data collection system and a verification protocol to ensure data quality. This provides:

- Better control of tonnages of WEEE collected in a higher and complex network of collection points;
- Monitoring of compliance and tonnages of WEEE arising and collected;
- Coordinates reporting from actors involved.

Many stakeholders have emphasised the importance of data quality and transparency for the proper functioning of the matching methodology. For matching by collection points, data on historical WEEE arising per collection point is the key reference for allocation. Indeed, the Italian interviewee recalled that, in the initial stages of matching, lack of historical WEEE data had meant more need for balancing. The Danish system also relies on historical WEEE per capita and current number of residents in a municipality or local authority to allocate collection points. The Danish system has also specified in the methodology how to correct data errors if any arises. The Norwegian system has benefited from transparent data platforms and an external auditor validating the annual reports. On the other hand, the German stakeholder highlighted false entries as a notable source of error, as some of the reported pick-up quantities seem implausible. Such errors open the system up to criticism. The clearing house has established extensive control mechanisms to correct false entries as quickly as possible, and it is constantly checking on the effectiveness of these mechanisms. Cooperation from all producers is required as the matching system relies on accurate data to function reliably.

Given that in the UK data are reported quarterly by PCSs to environmental regulators as well as by WDAs via WasteDataFlow (WDF), there could be opportunities to streamline the process and further improve the data quality, if a clearing house is established to manage this central data platform. The implication of central coordination of information flow is elaborated in Section 6.1.1.2.

Table 4 summarises the success factors raised by interviewees. These were considered when evaluating the feasibility of matching in the UK in Phase 2 of this study.

Table 4 Success factors for matching

Number of PCSs and the competitive landscape The matching methodologies identified in this study vary from a well-defined algorithm (e.g. in Italy) to more commonly a collaboration and negotiation based process. Some interviewees (e.g. from Ireland and Sweden) felt that their collaboration based processes work efficiently, but crucially because there are only two PCSs, which makes communication and coordination straightforward. The Swedish interviewee felt that if there were an increase in the population of the country, or in the number of PCSs, the assignment of collection points could be a more efficient method than the current contract based arrangements, as collection points could be clustered to allow for more efficient transport. The Irish interviewee stated that there being only two PCSs allowed for open and ad hoc communication enhancing the efficiency and flexibility of the system. However, it should be noted that one UK retailer with presence in Ireland has indicated that conflicts have occasionally arisen over attribution of WEEE collected from different PCS-managed territories, triggered by retailers' moving sites across territories. From the retailer's perspective, the process of resolving these issues was complicated and caused additional administrative burden. Furthermore, the collection obligation and allocation of pick-up requests or collection points depend on the market share of the PCSs. When new PCSs are established or when there are many PCSs competing for members, the market share could fluctuate and cause more frequent changes in the matching set-up. One Italian stakeholder suggested a stable market share as a success factor for achieving the full benefit of matching. This has implications for the UK, as the total number of PCSs is currently higher than any other territories included in this study, and the number of PCSs currently partaking LA DCF collection (10) is comparable to Italy (12). The implication of matching on the number of PCSs and the nature of competition in the UK will be elaborated in Section 6.1.1.1.
The effectiveness and enforcement of matching is improved if the system is mandatory As matching is intended to create a level playing field, if it is optional for a PCS to be a member of the clearing house and participate in matching then competition would be distorted. Interviewees from Spain and Slovenia have highlighted this issue from their own experience with voluntary matching/ financial clearing systems. In Slovenia where there is only financial clearing, the stakeholder noted that compensation is not mandated by legislation. Furthermore, the voluntary financial clearing process is deemed inefficient and inconsistent, as it lacks an agreed method for setting the price for each WEEE stream. In addition, in Slovenia there is no physical matching of WEEE (i.e. by pick-up request, collection points or geographical split), and there is no obligation for PCSs to collect from each local authority to meet their targets. This has led to selective collection by some PCS. Another example of a voluntary system is in Spain, where three PCSs are not involved in the clearing house in terms of data reporting or matching, and simply collect WEEE to comply. One Spanish interviewee expressed that the system would be more effective if all PCSs were members of the clearing house.
Support from stakeholders Open dialogue and consensus-building with the affected parties is crucial when designing the matching methodology and associated policy initiatives, such as codes of conducts, protocols for methodology revisions, conformity criteria, etc.

Overcoming resistance to change from the current system

All matching systems by pick-up requests or collection points identified in this study were established in the early stages of WEEE legislation implementation. In the UK context, as the current system has been established (and evolved) since 2013, the resistance to change - and certain complexity of change - is expected to be a notable barrier for introducing matching, even if public consultation and impact assessment deemed it a beneficial solution for the UK. Some notable barriers include adapting to changes in stakeholder relationships and interactions under matching, and implementing necessary changes to the wider system that underpins matching.

Flexibility of the system

Matching could have unexpected consequences for the WEEE system if not carefully designed. At the outset, the matching system needs to be flexible for introduction of corrective measures in case there are economic distortions or deviations from the principles of extended producer responsibility.

Certain existing shortcomings in the wider WEEE system would continue to affect the robustness of the algorithm for matching. For example, 'free-riding' (e.g. from online international sales platforms) can affect the accuracy of the market share calculations which then feed into the algorithm for matching. Although the clearing house could have a role to play in enforcing EEE producer registration and identifying the potential scale of free-riding, it is a system-level issue that is likely to persist under matching.

Another example is the losses of WEEE from the official system. The quantities of WEEE that can be matched is limited by the amount of WEEE that is collected and made available for offtake by PCSs. Therefore, like the current tender-based system, collection quantities under matching could only increase if the wider system improves and losses are reduced across the board. If a clearing house is established as a result of introducing matching, then there is potential for the clearing house to coordinate efforts targeted at reducing losses. For example, WEEE is not always sorted correctly, since the cost of sorting and recycling certain streams of WEEE is lower than the value of materials recovered. As a result, a large volume of WEEE is classed as scrap metal within the waste system and not matched to a PCS. The Italian clearing house is trying to give visibility to these unreported flows, thereby improving the collection quantities in the official system. However, engagement with stakeholders and enforcement of rules are critical. For instance, all recycling operators in Italy (including the scrap metal dealers) are supposed to declare the quantities of WEEE they manage to the clearing house, in addition to their legal obligation to declare this information to public authorities. In reality, scrap metal dealers (and other actors outside of the official system) rarely declare information to the clearing house due to a lack of enforcement. The Italian interviewee has also indicated that even if mandatory handover were implemented to address this issue, its effectiveness in practice would still depend on funding and the action plan for enforcement.

5.3 Summary of existing matching systems

The interviews have affirmed that there is no one-size-fits-all solution where matching is concerned. The aim of this section is to compare the different systems and lay out the available (though not exhaustive) approaches and underlying rationale for consideration in the UK context.

5.3.1 Differentiating features of existing matching systems

The differentiating features of existing matching systems are presented in Table 5. Later in Section 5.3.2, learnings for the UK are organised by the same set of features.

Table 5 Different features and approaches taken by existing matching systems

Feature	Available approaches
Legal requirement for all PCSs to participate in physical collection	All matching systems investigated in this study require all PCSs to physically collect WEEE. The difference lies in the role of financial clearing for meeting compliance. For example, some territories (e.g. Slovenia, Sweden, Norway) have only financial clearing and not physical matching. In these cases, a PCS may choose to meet its obligation through financial clearing if it is deemed more cost-effective than expanding its collection network. In territories with physical matching, any PCS with B2C obligation would be required to collect a share of the WEEE arising according to the PCS's market share. PCSs would need to either physically collect by themselves or subcontract another PCS to collect on their behalf. In some cases, (e.g. Denmark), PCSs with very small market share would be allowed to collect from fewer areas rather than from every region.
Scale and scalability of matching	Matching could be used as a backstop option to ensure national coverage of WEEE collection and prevent orphan B2C collection points (see the approach adopted by Austria, or the PBS in the UK). Alternatively, in most territories interviewed where physical matching is involved, matching is the primary system and is implemented across all municipal collection points as a minimum, unless a municipal collection point opts out of the system (as is allowed in Illinois). The scalability of a matching system by number of participating PCSs and collection points depends on the level of reliance on stakeholder collaboration and negotiation, which can range from: • Primarily rely on stakeholder collaboration and negotiation (e.g. in Ireland and Illinois); • Manual process following a well-defined set of criteria with a degree of collaboration and negotiation (e.g. Denmark; Spain and France with fewer criteria); • Primarily rely on a mathematical algorithm to match pick-up requests or collection points with PCSs (e.g. Germany and Italy respectively).
Scope of matching	The scope of matching can differ in three aspects: 1. **Types of WEEE:** household B2C or non-household B2B WEEE;

	2. **Sources of WEEE:** a matching system can apply to LA DCFs and commercial DCFs (e.g. distributor and retailer in-store collections, reverse logistics hubs). Though not observed in existing systems, matching could also be extended to consolidation points for kerbside collection; 3. **Streams of WEEE:** in most cases matching is implemented to all streams of WEEE (some exceptions may apply for countries where there is only one PCS for a specific stream of WEEE); some clearing houses also oversee matching of batteries, though a separate algorithm would apply. The interactions between matching of WEEE and batteries are not explored in this study.
Flexibility for stakeholders to participate in matching	**For PCSs:** Matching can be voluntary (e.g. in Spain and Slovenia) or mandatory (everywhere else). Under a voluntary system, balancing and financial clearing amongst PCSs relies on collaboration and negotiation amongst PCSs; otherwise legal disputes may ensue. A mandatory matching system is typically enforced by a third-party independent organisation such as a clearing house or an environmental regulator. **For LA DCFs:** Some matching systems allow municipal collection points to opt in or out of the matching system in advance and instead contract a PCS (e.g. in Illinois, Germany, Austria and Spain). **For commercial DCFs:** Some matching systems allow large retailers to establish a contract with one single operator or PCS rather than being serviced by many different PCSs under matching. Individual collection systems organised by producers (rather than by a PCS) typically do not participate in the matching system, but the amount collected by the producer can offset the collection responsibility allocated to the producer's PCS. B2B collection channels typically do not participate in the matching system.
Fair distribution of access to WEEE arising from DCFs and cost differentials	The mechanism for fairly distributing access to the WEEE arising from DCFs can vary in terms of criteria considered: • Market shares of PCSs for each stream of WEEE: considered in all territories with matching by pick-up requests, collection points or geographical split. Illinois further accounts for the historical share of collected tonnage by each stream; • Expected WEEE arising per site/area: considered in all territories with matching by collection points or geographical split; • Minimise the number of PCSs allocated in the same collection facilities: considered in Italy, Denmark, and Illinois; • Every PCS has to work with the same logistic complexity and difficulty: considered in Italy, Denmark, and Illinois; • Every PCS has to work in every part of the country: this is achieved either by the algorithm for matching or by rotating island/remote locations among PCSs (Italy and Denmark respectively); • Minimise the number of changes and conserve as much as possible the same relationships between PCSs and collection facilities: considered in Italy, Denmark, and Illinois. In Illinois, both the PCSs and LAs may submit their preferred partners; these preferences feed into the manual matching process though the preferred pairs are not guaranteed due to negotiations; • Group LAs in a way that as far as possible they constitute a coherent geographic area: considered in Denmark and Ireland;

	• A municipality or LA, or an inter-municipal/inter-LA waste management partnership, is the smallest unit with regards to matching by collection point, meaning they shall be allocated as a whole to a PCS: considered in Denmark, Ireland, and Illinois. In Illinois, only the largest county is split and matched to three PCSs. Note that where there is only financial clearing, fair distribution of access to WEEE arising from DCFs and cost differentials is not guaranteed.
Minimisation of logistical inefficiencies and negative environmental impacts	Some matching systems have criteria to: • Group collection points and municipalities where possible to enable regional synergy in route and schedule planning: considered in Denmark and France; • Minimise the number of PCSs and their subcontractors being routed to each collection point and consequently, the total travel distance to AATFs per tonne of collection: considered in Italy and Denmark; • Improving the cost-effectiveness and reducing the environmental impact (notably carbon emissions from transportation) by encouraging pick-ups of a certain minimum weight/volume: required in Germany and incentivised in Italy.
Facilitation towards long-term stability	Some matching systems have built-in mechanisms to minimise changes and facilitate stability amongst stakeholders. This can be achieved by: • Setting a threshold for changes in PCSs' market shares to be addressed by re-allocation (France, Ireland); • Setting a maximum period before significant, persisting deviations between actual and obligated collection quantities must be addressed by re-allocation (France).
Reduced administrative burden and complexity	Some matching systems have built-in mechanisms to reduce the administrative burden and complexity by: • Reducing the number of PCSs matched to a collection point for offtake of various WEEE streams (related to the previous feature); • Streamlining the collection requests, data reporting, complaints, financial clearing, and other inter-stakeholder communications via a central coordination body.
Minimise level of physical balancing or financial clearing required	Since the actual quantities collected by a PCS will inevitably deviate from its obligated share of collection, some matching systems have built-in mechanisms for fine-tuning such deviations throughout the year to reduce the level of balancing required at the end of a compliance period. Alternatively, a matching system can rely only on balancing at the end of the compliance period by: • Financial clearing; • Temporary re-allocation of collection sites; • Re-attribution of collected tonnages and associated costs from one PCS to another to achieve balance: implemented in Austria as there are only a small number of WMCs in the country.

Fairness and transparency of physical balancing and financial clearing	Some matching systems have built-in mechanisms to mitigate against inflation of costs for balancing and financial clearing by: • Limiting the level of deviation between actual and obligated collection quantities that can be rolled over to the following year, allowing sufficient supply and demand of WEEE (or evidence of collection) for PCSs to transact among themselves and reach their balance; • Clearly defining the methodology for calculating the cost of balancing/financial clearing, and employing a third party to validate the collection data and costs submitted by each participating PCS.

5.3.2 *Learnings from existing matching systems*

This section presents the learnings from existing matching systems, focussing on the challenges identified by the interviewees and the project team for matching by pick-up request (Table 6) and by collection points (Table 7). Alongside each known challenge, potential solutions are suggested to inspire innovative and progressive approaches to matching when considered in the UK context.

Matching by pick-up request: in parts of Austria and Spain, and across Germany

Table 6 The challenges of matching by pick-up request, with adjustments for consideration in the UK

Feature	Identified challenges	Potential adjustments for consideration in the UK
Legal requirement for all PCSs to participate in physical collection	All participating PCSs (or producers in the case of Germany) are obligated to respond to the pick-up requests assigned to them. There is no flexibility for PCSs with small market shares or with a B2B focus. If this approach is taken, a significant number of PCSs in the UK could be affected due to lack of scale or experience to respond to pick-up requests anywhere in the country.	The matching system could incorporate flexibility for PCSs with small market shares and/or B2B focus. For example, a PCS with market share below a threshold could be allowed to fulfil its obligations by contracting another PCS to collect on its behalf.
Scale and scalability of matching	There is no track record of matching by pick-up request functioning at scale in a system with competing PCSs and WMCs, and non-standardised assets for WEEE storage and collection. Two of the three existing examples apply matching by pick-up request at a small scale in terms of tonnages coordinated and geographic coverage of areas. In Germany, the method is implemented at a large geographic scale but its operation hinges on the standardisation of container sizes for each WEEE fraction. Standardisation of assets also enables the setting of a legal minimum pick-up	To make this method scalable in the UK context, assets for WEEE storage, collection, and transfer/bulking need to be standardised across DCFs, council/ WMC depots, and waste transfer stations so that WMCs can swap them on a like-for-like basis. This would incur a significant cost for the transitional period. It is worth noting that some PCSs in the EU Member States are trying to improve the quality and safety of logistics by using special containers (e.g. sturdy/maritime containers) to avoid thefts in high-risk areas. Special small cages are being used for avoiding fires with WEEE that

Feature	Identified challenges	Potential adjustments for consideration in the UK
	quantity for each request which improves the environmental footprint and the cost-effectiveness of the process. In other case studies, there is typically a common agreement amongst PCSs to share the same logistics service suppliers, though this is not a solution welcomed by the industry and is unlikely to be scalable in the UK given the competitive landscape of PCSs and WMCs.	contains Li-ion batteries whilst being ADR[8] compliant. Such developments add more complexity to the standardisation of containers. Finally, it will be necessary to evaluate the complexity in DCF operation, existing arrangements for collection schedules, and the typical tonnage per collection from different DCFs, before a reasonable minimum pick-up quantity can be set. This is further complicated by potential kerbside collection of WEEE, which could involve more facilities in matching, such as council/WMC depots, and waste transfer stations across the UK.
Scope of matching	There is no track record of matching by pick-up request functioning at scale for WEEE arising from non-municipal routes, such as from retailer collection points. Only Austria includes some sites set up by other actors (e.g. producers, retailers, waste collectors) that opt into the matching system. The geographic scalability of this model is questionable. More importantly, both inclusion and exclusion of non-LA DCFs in matching would have their own associated risks in the wider UK system. These risks, such as disruption to existing reverse logistics systems, increase of administrative burden for PCSs and non-LA DCF operators, and potential for non-LA DCF operators to unduly benefit from economic rents, are discussed in detail in Section 5.1.1. Compared to matching by collection points, matching by pick-up request would exacerbate these risks due to the more ad hoc and less stable approach.	Distributors obligated to offer in-store collections[9] will have various storage and collection set-ups. Four (out of eight) retailer survey responses also indicated that their monthly collection volume can be highly variable for in-store collections, making it difficult to standardise assets or establish a pattern for collection. Another major UK retailer has indicated that in-store collections are currently not tracked by store and only weighed after consolidation at a delivery hub, therefore attempting to match retailer stores to PCSs by market share will be challenging. Furthermore, some distributors consolidate product returns and take back from customers at delivery hubs. For such distributors, central hubs may be better suited for matching than store locations. Still, administrative burden for both PCSs and distributors are likely to increase, since more stakeholder relationships will need to be maintained. In summary, including non-LA DCFs in matching by pick-up request in the UK is a complex and costly option with few discernable benefits.

[8] ADR refers to the Agreement concerning the International Carriage of Dangerous Goods by Road, a United Nations treaty that regulates the construction, equipment, and use of vehicles for the transport of hazardous materials. Source: https://unece.org/about-adr
[9] Valpak, 'WEEE Distributor Take-Back Scheme', n.d. https://dts.valpak.co.uk/.

Feature	Identified challenges	Potential adjustments for consideration in the UK
Flexibility for stakeholders to participate in matching	The level of enforcement and the resulting effectiveness of the matching system is less than ideal where it is voluntary for PCSs to participate. This is highlighted as a notable barrier for the Spanish system.	If WEEE matching were to be introduced in the UK, the system should be mandatory for all PCSs, but with the possibility of greater flexibility for PCSs with small market shares and/or B2B focus.
Fair distribution of access to WEEE arising from DCFs and cost differentials	As previously discussed, there is no flexibility for PCSs with small market shares that may have a smaller-scaled and/or regional collection network. Additionally, PCSs with large market shares that are not diversified in sources of collection (i.e. rely heavily on municipal collection) could shoulder higher operational and financial uncertainty at the beginning of the compliance period, since in the three existing examples, pick-up requests are assigned according to the PCSs' market shares and collection up to date. Last but not least, existing examples of implementation do not explicitly distribute out cost differentials fairly to all PCSs; instead, the algorithm for matching by pick-up request assumes that all PCSs have equal chance of benefiting from a low-cost collection as well as being exposed to a high-cost one. There is currently no data validating this implicit assumption.	Flexibility could be introduced by allowing subcontracting amongst PCSs. The assumption about equal chance of low- and high-cost collections could be made explicit if matching by pick-up request were to be implemented in the UK. For instance, all LAs can be graded according to their socioeconomic conditions, and the algorithm for matching pick-up requests could include a secondary criterion: let each PCS's share of pick-up requests from each type of LA be as close as possible. For example, if two requests come through, instead of assigning strictly by a first-come-first-served basis, the system could assign the later request from a low-cost area to the top priority PCS if it has predominantly collected from high-cost areas up to date, as long as the other request does not result in a deviation from the set collection obligation for the PCS that is second in line.
Minimisation of logistical inefficiencies and negative environmental impacts	As highlighted previously, assets need to be standardised across all collection points for matching by pick-up request to function effectively. The ad hoc nature of pick-up requests could hinder route and schedule optimisation by PCSs and WMCs, which could result in significant logistical inefficiency and environmental impact especially if implemented in a large geographic area with complex make-up of accessibility of collection points and AATFs.	Apart from standardisation of assets, there is also opportunity to build in more predictability in the algorithm. For instance, if historical data (e.g. from WDF) were analysed and LA DCFs could be ranked based on their historical WEEE arising (e.g. using the median as an indicator), then the algorithm may be better able to forecast the sequence and frequency for pick-up requests from LA DCFs territory-wide, allowing PCSs with large market shares and their subcontractors to plan ahead.

Feature	Identified challenges	Potential adjustments for consideration in the UK
Facilitation towards long-term stability	The ad hoc relationship between collection points and PCSs (or producers in Germany) limits the system's stability and may hinder long-term relationship development for proactive efforts such as driving higher collections and piloting new collection and re-use initiatives.	As suggested above, if the algorithm for matching is built to allow greater certainty and collaboration between PCSs with large market shares and LA DCFs with historically large amounts of WEEE arising, then there could be more opportunities to develop longer-term relationships and drive higher collection and re-use.
Reduced administrative burden and complexity	The ad hoc nature of pick-up requests could mean that DCF operators and AATFs would need to coordinate with multiple PCSs and their subcontractors. This could increase the administrative overheads for DCF operators and for AATFs (e.g. with regard to coordinating collections). In all three examples of matching by pick-up request, this challenge is addressed by having a coordination body that acts as the central point of contact and data gathering, though there is no data for a comparison of variable administrative costs amongst territories with/without a coordination body.	Existing matching systems indicate that a coordination body would be essential. There may be flexibility for each devolved administration to have its own coordination body to potentially allow for groupings of regional requests. However, this approach would also likely result in duplications of overheads and administrative efforts, as well as a fragmented UK WEEE system that operated by different sets of rules for matching.
Minimise level of physical balancing or financial clearing required	Matching by pick-up request allows PCSs to track their progression towards their collection obligation at a more granular (i.e. per haulage) level. As a result, significant deviations from allocated collection obligations could be pre-empted. Balancing and financial clearing would therefore be more limited under this set-up as compared to matching by collection points or by geographical split.	There is an opportunity to incorporate rules around how much deviations ought to be balanced rather than rolled over to the next compliance period, as well as a methodology for calculating the cost of evidence notes for balancing. This would ensure sufficient supply of evidence notes with prices reflecting the cost of collection.
Fairness and transparency of physical balancing and financial clearing		

Matching by collection points in: Italy, Denmark, Illinois, France and most of Spain

Table 7 The challenges of matching by collection points, with adjustments for consideration in the UK

Feature	Identified challenges	Potential adjustments for consideration in the UK
Legal requirement for all PCSs to participate in physical collection	As with matching by pick-up request, all participating PCSs are assigned at least one DCF or LA and there is no flexibility for PCSs with smaller market shares and/or B2B focus.	A threshold rule similar to that suggested in Table 7 for matching by pick-up request could still be applicable under this approach.
Scale and scalability of matching	Across all five examples, matching by collection points is the default or primary (in the case of Spain) option across the territory. Matching by collection points following a mathematical algorithm, as is the case in Italy, is deemed a more scalable solution as it eliminates ambiguity from the matching process and reduces the resource/time inputs for repeat roundtable negotiations. However, implementation of a similar algorithm and the associated logistical implications are expected to be more complex in the UK with 28 PCSs and long-running relationships amongst stakeholders, compared to starting with a clean slate. Although currently there are only 10 PCSs that hold bilateral agreements with LA DCFs[10], some of the remaining 18 PCSs could begin collection from LAs under a matching system. During stakeholder engagement, two PCSs that do not currently collect from LAs expressed the desire to do so.	In addition to minimising future changes to relationships as in the Italian algorithm, a UK algorithm could be designed to minimise disruptions to existing and especially long-running relationships. For example, PCSs could submit in confidence a register of the number of years that they have worked with a particular LA. This can be ranked and relationships beyond a certain number of years could be 'reserved' and not reshuffled by the algorithm for matching. This would support a smoother transition to matching.
Scope of matching	In the examples, only Italy included 820 non-municipal collection points in the matching system. In all other territories, non-municipal collections (including B2B WEEE) are not matched to PCSs, but the resulting tonnages are reported to the	Regardless of how the scope is drawn, matching in the UK needs to be accompanied by system-wide reforms to ensure that: • WEEE holders and PCSs are appropriately motivated to improve

[10] The 10 schemes are (in alphabetical order): Electrolink, ERP, Recolight, Recycling Lives Compliance Services, REPIC, Transform, Valpak, Veolia, WEEE Link, and WeeeCare. This list was updated on 1 October 2018: https://www.gov.uk/government/publications/weee-list-of-local-authority-designated-collection-facilities/weee-list-of-local-authority-designated-collection-facilities

Feature	Identified challenges	Potential adjustments for consideration in the UK
	clearing house and contribute to PCSs' collection obligation. As mentioned before, the risks associated with both inclusion and exclusion of non-LA DCFs in matching are discussed in detail in Section 6.1.1. Introducing matching in the UK would face greater complexity than in the other territories because of the potential tension with the current target/compliance fee system, as well as the existence of vertically integrated distributors and WMCs who own/operate PCSs and/or AATFs.	the quantity and quality of collection; • PCSs and their subcontractors are appropriately motivated to align activities with circular economy principles, e.g. driving re-use; • No economic distortions are created, no WEEE holders may unduly benefit from charging an economic rent for uplift from PCSs, and a truly level playing field is maintained. Some suggested mitigation strategies against the above concerns are detailed in Section 6.3. In addition, a UK matching system may build in the flexibility to allow orphan private DCFs (e.g. retailer sites that cannot reach a bilateral agreement with a PCS) to opt into the matching system. B2B WEEE could have a separate matching methodology since B2B WEEE disposal patterns and flows are notably different from B2C WEEE. If B2B WEEE (e.g. dual use) contributes to the achievement of collection targets, it should be reported to the matching system so it is considered for the calculation of the collection obligation. Depending on what financing obligation is legally required for B2B WEEE, a UK clearing system may include a parallel formula for avoiding orphan B2B WEEE.
Flexibility for stakeholders to participate in matching	As discussed in Table 7, a mandatory system in which a third party holds the power to enforce rules and execute contingencies is essential for creating a reliable and effective matching system.	As discussed in Table 7: a UK matching system should be mandatory with a degree of flexibility for PCSs with small market shares or B2B focus.
Fair distribution of access to WEEE arising from DCFs and	Matching by collection points ensures fair access to WEEE according to PCSs' market shares across POM EEE categories, whilst allowing more stability	There is an opportunity to adjust the Italian algorithm for the UK context, building on a comprehensive study to map the cost differentials in WEEE collection and treatment across UK LAs/geographic areas.

Feature	Identified challenges	Potential adjustments for consideration in the UK
cost differentials	in the system compared to matching by pick-up request. A detailed understanding of the range, distribution and root causes of cost differentials across the nation is essential for a successful implementation of this method. As one UK PCS pointed out during stakeholder engagement, a high-cost area could be due to various local conditions, such as very rural areas with long transportation distance, very urban areas with more severe traffic congestion, areas with large fractions of flats or transient populations making it more difficult to engage residents in proper disposal of WEEE, etc. Some of these factors have been highlighted in a previous study on the economic and environmental impact of kerbside collection of waste electricals.[11] It has also been raised by stakeholders that similar work is being undertaken for the Packaging EPR consultation, and there could be transferable learnings for the WEEE sector.	For example, a more explicit grading of logistical complexity for each LA/ geographic area could be established. In the Italian algorithm, fair distribution and equal logistical complexity are implied by requiring all PCSs to work in each of the 15 geographic zones. However, a grading of Waste Disposal Authorities (WDAs) and potentially of Waste Collection Authorities (WCAs) if kerbside collection of WEEE becomes mandated could improve the transparency of the method and allow more flexibility in the matching process.
Minimisation of logistical inefficiencies and environmental impact	In all five examples, separate WEEE streams from DCFs are matched to PCSs. Although some algorithms for matching and criteria seek to minimise the number of PCSs matched to each DCF, there remains the possibility that more than one PCS may operate at a given site. This means that while individual PCSs may have the business drivers to optimise their logistics for certain streams, DCF-wide efficiency would be more difficult to improve as competing PCSs will need to coordinate their collection routes and destinations (AATFs). Therefore, a one-to-many type of DCF-PCS interaction would likely result in sub-optimal UK-wide efficiency and associated environmental impact. This is a known	As seen in Denmark, one option to facilitate regional efficiency is to cluster LAs and form a coherent geographic area when allocating them to a PCS. A similar approach could be adopted in the UK. In this regard, the opportunity to grade LAs as described above could also shed light on the existing mix of low- and high-cost areas serviced by a particular PCSs. This could then feed into the algorithm or negotiations for maintaining a level playing field whilst minimising disruptions to LA-PCS-AATF relationships. It should be noted that the coordination between non-LA DCFs such as distributor collection points and PCSs would be more challenging than for LA DCFs. This is because distributors will need to manage DCFs spanning across the country rather

[11] Oakdene Hollins and SUEZ, 'A Review (Economic and Environmental) of Kerbside Collections for Waste Electricals', Material Focus, July 2021, https://www.recycleyourelectricals.org.uk/report-and-research/a-review-of-kerbside-collections-for-waste-electricals/.

Feature	Identified challenges	Potential adjustments for consideration in the UK
	challenge as highlighted by some UK AATFs for LA DCFs in the PBS. Indeed, there is an inherent trade-off between UK-wide efficiency and maintaining a competitive market with multiple PCSs. Matching streams rather than whole DCFs enables PCSs to more closely align their actual collection quantities with their obligation for each EEE category, thereby reducing the level of balancing and financial clearing. As previously highlighted, applying matching to the UK also presents a unique challenge of potentially disrupting the efficiencies that PCS have developed over the years, e.g. by strategically tendering with LAs and selecting AATFs to optimise services and costs. If the Italian algorithm were applied in the UK as is, these synergies could be lost due to fragmentation.	than confined to a LA. If distributor DCFs are matched to (likely multiple) PCSs, then it would be essential to ensure all PCSs align their terms of service regarding collection and treatment.
Facilitation towards long-term stability	In the five examples, only France (with two PCSs in the matching system) has a 2-year limit before persistent and significant deviations between actual and obligated collection quantities would trigger re-allocation of DCFs. In all other territories, the algorithm for matching is updated annually with the latest data on PCSs' market shares, and the least number of DCFs would be re-allocated to reflect changes in market shares. Matching ties PCSs' access to DCFs with their market shares. In the UK where there will likely be more than 10 PCSs undertaking LA collections in a matching system, the competitive environment could lead to more movements of producer members in pursuit of better value proposition from PCSs. Therefore, matching in the UK may experience more significant re-allocation, especially in the early stages of a matching system. During UK stakeholder engagement, several PCSs and AATFs supported a longer review period for DCF-PCS	A UK WEEE matching system could incorporate a threshold level for fluctuations in PCSs' market shares, below which deviations could be balanced via evidence trading. Determination of this threshold will need to be informed by historical market share fluctuations and the cost-benefit implication of relying on balancing rather than re-allocation to address these fluctuations. Furthermore, the algorithm can keep track of the historic re-allocation of each DCF, so when the re-allocation of a DCF is required, the algorithm could suggest the one that has been re-allocated the fewest times (without breaking the algorithm's primary objective of fairly allocating WEEE arising and cost differentials).

Feature	Identified challenges	Potential adjustments for consideration in the UK
	matches, e.g. having a triennial rather than annual re-allocation. This reflects an inherent trade-off between system stability and fair access to WEEE based on the most up-to-date data on PCSs' market shares.	
Reduced administrative burden and complexity	As discussed previously, a one-to-many type of DCF-PCS relationship could cause not only inefficiencies and negative environmental impacts, but also greater administrative burden for stakeholders. For instance, DCF operators (LAs or distributors) may need to coordinate multiple PCSs and WMCs. PCSs may need to service more distributors across the country than their current contracts. Collection and attribution of evidence notes to different PCSs could be more complex for AATFs if more DCFs were split by PCSs.	Other territories have addressed these administrative challenges by streamlining the process of requesting and responding to collection requests and centralising data flows through a clearing house. In the UK, many PCSs have already established sophisticated systems to respond to, track, and report on collection requests. Both PCSs and LAs would already have experience in and tools for managing multiple sets of administrative tasks. Therefore, a UK clearing house may not need to duplicate efforts in this area. A clearing house would still need to consolidate data on PCSs' market shares, WEEE arising across DCFs and WEEE collected by PCSs, in order to update the algorithm for matching. It is highly advisable that fragmentation by nation is avoided, for example by having one single clearing house for the UK.
Minimise level of physical balancing or financial clearing required Fairness and transparency of balancing and financial clearing	Matching by collection points relies on data on historical WEEE arising from a DCF, by metrics such as kg arising per capita in the WDA/WCA. With this approach, balancing and financial clearing is indispensable and unavoidable, because predictions of WEEE arising at DCFs will not be exact. A challenge faced by interviewees across the five example territories is the shortfall of data in early stages of the system for projecting future WEEE arising per DCF. Since the UK is not starting with a clean slate and has already established the public WDF platform, data availability is a less significant challenge. However, the quality, timeliness, and consistency of	In addition to the possibility of ensuring the sufficient supply and demand for evidence notes and improving the transparency of pricing evidence notes (detailed in Table 7), there is an opportunity to improve the efficiency of data management by integrating WDF in the clearing house's IT infrastructure.

Feature	Identified challenges	Potential adjustments for consideration in the UK
	WDF data inputted may need improvements to better inform the matching process.	

Matching by geographical split in Ireland

Matching by geographical split is a unique arrangement in Ireland. It is feasible largely because the country has a relatively small surface area to cover and there are only two PCSs. This method can be viewed as a simplified version of matching by collection points, achieving more extensive clustering of LAs than the previous five examples. Most of the challenges and potential adjustments for the UK therefore translate to this method. A notable challenge for implementing matching by geographical split in the UK is to establish a large number (likely 10+) of coherent geographic zones whilst ensuring fairness of cost differentials within each zone. Additionally, this method would effectively exclude certain PCSs from operating in certain regions, which could be construed as anti-competitive. In this regard, a simplistic geographic split has relatively low feasibility in the UK.

6 Phase 2 results: Feasibility analysis of matching in the UK

6.1 Practical considerations of matching for the UK WEEE system

6.1.1 Implications for the current system

The purpose of matching is to level the playing field by providing coordination to the sector, reduce resources expended on competing for access to WEEE, and focus competition on the quality, scope, and scale of services offered by PCSs to producers. Although matching is primarily an administrative and coordinating mechanism, it should ultimately facilitate, rather than hinder, the goals of the wider WEEE system, which are to collect more WEEE at better quality and to achieve a more circular system.

The specific benefits and drawbacks of each matching methodology in the UK context will be discussed in Section 6.2. This section focuses on the system-level implications of matching in the current UK system regardless of the choice of matching method. The implications of potential system-wide reforms on matching are discussed in Section 6.1.2.

The system-level implications of matching for the current system can be understood from three aspects:

1. Matching would define and provide a level playing field for PCS competition and quality of service, in respect to WEEE collection (at least from LAs).
2. Matching would introduce central coordination of some aspects of the WEEE system and potentially also enhance information flows.
3. Matching would influence PCSs' business drivers and approaches to innovation and competition.

6.1.1.1 Define and provide a level playing field for PCS competition and quality of service, in respect to WEEE collection

A level playing field means that PCSs operate by the same set of rules and that these rules are enforced by a credible authority. Examples of a level playing field from existing literature include:[12]

- All PCSs operate under the same definitions of household / non-household WEEE.
- Equal obligations among PCSs, and particularly rules around minimal geographical coverage so as to avoid selective collection.
- Minimum standards for a PCS to maintain its operating licenses, in order to prove it is a credible system.
- Minimum requirements on information for consumers (e.g. annual reports) and auditing.
- Strict enforcement by authorities.

Other examples of a level playing field gathered from WEEE Forum members include:

- Equal obligations to collect both net-cost and profitable WEEE streams alike according to PCSs' market shares in the relevant EEE categories.
- All PCSs are required to comply by physical collection (i.e. act with organisational responsibility and beyond being only a financer).

[12] BIO by Deloitte, 'Development of Guidance on Extended Producer Responsibility (EPR)', 2014.

- Minimum treatment requirements are put in place, in accordance with harmonised standards.

During stakeholder engagement, some PCSs raised two issues with the current UK WEEE system that could be construed as creating unfair conditions for competition. The first issue is that, currently, a large number of PCSs (18 out of 28) achieve compliance with limited to no participation in physical collection. Some of these PCSs may specialise in B2B and have limited to no B2C obligation, while others are so small in scale that it is more commercially competitive for them to trade evidence notes than to establish their own network for collection and treatment. A matching system would level the playing field by requiring all PCSs with B2C obligation to comply by participating in collection either directly (i.e. establishing their own collection and treatment network) or by contracting another PCS to collect on their behalf. PCSs can no longer rely only on buy-out options such as evidence purchasing and compliance fees (if these mechanisms are maintained). Service standards could be implemented and monitored to ensure all PCSs collect and treat WEEE to the required standard. Since matching will mandate PCSs to participate in physical collection (beyond only financing it) to a nationally agreed standard, it means that the minimum requirements for PCSs would effectively rise. Some of the existing PCSs may not have operational capabilities to collect to the agreed standard, and therefore could discontinue operation. If such PCSs exit the market, then there would be less duplicated overheads and staff costs within the WEEE system.

The second issue is that selective collection is currently allowed in the UK. Selective collection means that, without regulatory obligations for each PCS to operate in every part of the country, PCSs are naturally driven to focus competition on the profitable WEEE streams in commercially advantageous locations. This has led to the issue of orphaned WEEE from certain LA DCFs, i.e. WEEE that is not covered by a contract with a PCS because of the high cost of collection and treatment. The mandatory PCS Balancing System (PBS) has been operating as a safety net to the orphaned WEEE from LA DCFs; however, the PBS only distributes costs by PCSs' market shares effectively still allowing some PCSs to meet compliance through predominantly financial means. Under matching, selective collection would be mitigated and there would no longer be a need for the PBS. The LA DCFs currently covered by the PBS would be matched out to PCSs. It should be noted that smaller PCSs could be less resilient to increases in cost of collection and treatment if newly matched to costly WEEE streams/DCFs.

During Phase 2 engagement with UK stakeholders, one PCS voiced concern about distorted or reduced competition as a result of matching. Specifically, there is a perceived risk that matching could drive PCSs towards similar strategies and operations (e.g. incurring similar costs, charging similar rates, collecting and treating WEEE through similar systems), and stifle innovations.

However, our research shows that a level playing field does not mean every company will be equally successful, nor does it inevitably lead to the same service offerings across PCSs. Indeed, existing literature has highlighted that imitation of competitors is also present within a competitive system amongst multiple PCSs.[13] Under matching, PCSs can still differentiate their collection and treatment services, and some PCSs would still hold competitive advantage over others. For example, competitive advantages could originate from factors such as scale, available resources, skills, networks, experience, internal initiatives, etc.

Moreover, PCSs would still be able to differentiate their value proposition and compete on other fronts such as providing support for producer compliance, or offering technical expertise as consulting services.

[13] Filippo Corsini, Francesco Rizzi, and Marco Frey, 'Extended Producer Responsibility: The Impact of Organizational Dimensions on WEEE Collection from Households', 2017, https://www.sciencedirect.com/science/article/pii/S0956053X16306158.

The perceived risk to innovation would also require system-level interventions to create the appropriate incentives. Additionally, improvements and possible cost saving could come from businesses identifying non-compliant activities.

6.1.1.2 Introduce central coordination of the WEEE system and enhance information flows

A significant implication of matching is that PCSs will no longer need to individually tender for access to WEEE arising at DCFs. At a minimum, a matching system would apply to LA DCFs. Matching could also be extended to DCFs operated by distributors. This section breaks down how WEEE flows and stakeholder relationships would be affected by a matching system and a clearing house. The impact scenarios have been informed by UK stakeholder engagement.

Between LAs and PCSs

From a LA's perspective, a successful matching system hinges on providing guarantees regarding service quality and waste duty of care, especially considering that some PCSs may be comparatively inexperienced in collection from LAs and/or distributors. Matching therefore necessitates supplementary initiatives such as developing minimum service level agreements and contingencies. Standardised contracts can be implemented between PCSs and LAs. PCSs may also be required to submit operational plans to demonstrate their ability to meet the minimum service level.

Any bespoke contractual terms or arrangements between LAs, WMCs and PCSs would be replaced by standard terms if these are not part of national service level agreements. However, if a current bespoke arrangement is justified under the full net cost principle, then it could be negotiated and standardised in the service level agreement resulting in a benefit to all DCF operators. One example of this may be the inclusion of social value commonly sought in public tenders.[14] One PCS deemed this to be within the remit of PCSs and suggested that LAs and PCSs could collaboratively establish guidelines on what social value constitutes in the context of the WEEE sector, so that a matching system could retain but standardise how these benefits are delivered to LAs.

During UK stakeholder engagement for this study, two PCSs raised the issue that the requested service level and the evaluation criteria of current public tenders vary greatly. Given the PCSs' legal obligation to collect WEEE for free, some LA DCF operators have requested service terms beyond quality of collection and treatment. Beyond the point on social value discussed above, Eunomia's study on the Extended Producer Responsibility for (W)EEE highlighted that some PCSs have revenue-sharing arrangements with LAs especially for commercially attractive streams such as LDAs.[15] This was confirmed by one PCS participating in this study as an occasional practice as a condition for accessing WEEE from certain LA DCFs. The stakeholder has also suggested that such practices have distorted the playing field, making it virtually impossible to provide an accurate quote to potential members as other PCSs may take on additional financial risks to win a bid.

Table 8 shows the weighting of the variability in evaluation criteria assigned to social value, added value, community benefits, and other additional services specified in the invitations to tender received by one PCS.[16] The weighting ranges from 7% to 25% when evaluated separately from Quality of Service. Since

[14] 'Public Services (Social Value) Act 2012' (Queen's Printer of Acts of Parliament, March 2012), https://www.legislation.gov.uk/ukpga/2012/3/enacted.
[15] Mark Hilton, Orla Woods, and Alice Johnson, 'Electrical and Electronic Equipment: Ingredients for Successful Extended Producer Responsibility', Eunomia, January 2020, https://www.eunomia.co.uk/reports-tools/electrical-and-electronic-equipment-ingredients-for-successful-extended-producer-responsibility/.
[16] Private correspondence with a major scheme in the UK

this is based on one PCS's experience, it may not be fully representative. Nevertheless, it illustrates the potential ambiguity and financial risk to the tendering PCSs (and therefore their scheme members) to access WEEE from certain sites.

By standardising the bespoke arrangements, matching would level the playing field, improve access to WEEE for some PCSs who may be currently unwilling or unable to take on bespoke arrangements. It would also reduce PCSs' uncertainty in costs and hence financial risk exposure, and save resources previously expended on designing bespoke arrangements in contracts. This will also mean all relevant costs and associated revenues would pass to PCSs in line with the full net cost principle.

Matching would also mean that, subject to meeting the required service standard, all PCSs would be able to access DCFs, thereby removing current barriers to entry. More PCSs would participate in collection and their reliance on buy-out options such as evidence trading and use of the compliance fee would decrease. For instance, PCSs with small market shares would also be required to collect WEEE from (at least) LA DCFs proportionate to their market shares. This would level the playing field as all PCSs would need to undertake physical responsibility for the management of WEEE.

Since matching would lead to the creation of a clearing house, the clearing house may also serve as a platform to facilitate discussions amongst PCSs and LAs on topics of common interest, such as improving and standardising public communications.

Lastly, matching would formalise the rules that dictate the stability of the system. For example, changes would occur periodically, typically annually, based on the matching methodology. AATF stakeholders have highlighted that, in the current system, uncertainties and short-term disruptions resulting from contract changes and terminations prevent them from establishing long-term agreements with PCSs.

Table 8 Overview of recent invitations to tender and the weighting for value-added services

Region	**Year**	**Weighting for value-added services** (e.g. social value, community benefits, additional services, etc.)
West Midlands	2017	20%
Devolved Administration	2018	20%
North England	2018	50% (Combined score with evaluation for Quality of Service)
London	2018	25%
West Midlands	2019	Not disclosed, tendered by a Waste Management Company
East Midlands	2019	15%
North England	2019	7%
West Midlands	2019	10%
East Midlands	2020	25%
London	2020	Not disclosed, tendered by a Waste Management Company
West Midlands	2020	Not disclosed
Devolved Administration	2021	20%

Between distributors collecting WEEE and PCSs

The question of whether private DCFs should be included in a matching system has profound implications for not only the interactions between PCSs and distributors, but also the fairness and effectiveness of the wider system. Drawing on inputs from UK stakeholders, this section explains the justifications and risks for either approach.

Most participating UK PCSs and distributors expressed the view that including distributor facilities in a matching system would disrupt the currently functioning relationships and create significant administrative burden for both distributors and PCSs. Stakeholders are concerned that this could have significant unintended consequences such as creating a more costly and less efficient system with no discernible improvements to system performance.

As one PCS pointed out, there exists a close network between a PCS, the distributors that contract the PCS, and the PCS's producer members (possibly also including the distributors themselves). In some cases, the PCS's producer members may sell products through the contracted distributors. Therefore, distributors can not only raise service requests directly to PCSs, but can also feedback to the PCS's producer members about the service quality of the PCS. Within this close network, the PCS is driven to deliver quality and sometimes customised collection and treatment services by both the distributors and its producer members.

If matching included distributor DCFs, then this feedback loop could be disrupted. Unlike LA DCFs where existing relations could be preserved as much as possible by the algorithm for matching, the UK-wide presence of many distributors means that they would likely be matched to more than one PCS. From a PCS's perspective, this would fragment its access to WEEE from distributors, which could lead to less efficient and more costly operations. Currently, a distributor contracts a PCS to be wholly responsible for the collection and treatment of WEEE from all sites across the UK, and hence the PCS is able to reach scale of collection with full accountability. Under (any form of) matching, the PCS would likely be required to collect from a wider group of distributors across the country but with partial accountability i.e. only towards the matched collection sites. One-to-many distributor-PCS relationships mean that PCSs may need to invest in more staff for building relationships with more distributors for the matched collection points. For PCSs that currently struggle to access WEEE, the additional overheads may be justifiable by the matched tonnages of WEEE in return. However, for PCSs that already have established exclusive working relationships with large distributors and are already collecting their market share, the payback on higher overheads is less significant since the matched WEEE would not exceed their market share. With more one-to-many distributor-PCS relationships, PCSs could also be demotivated from offering customised services (e.g. supporting staff education, providing posters and flyers for the collection services, etc.). One PCS flagged that, if matching included distributor sites, it would lack the drive to provide service at a quality above and beyond the minimum service level agreement. This would be a notable negative implication to distributors as they may no longer have a one-stop shop for all their needs, such as:

- Direct and single point of control (e.g. from the company's headquarters) over contract terms that ensure free of charge, on-time, and consistent service (including consistency of containers used for on-site management).
- Rapid responses to queries.
- Direct and single point of control (e.g. from the company's headquarters) over the downstream supply chain from collection to treatment, ensuring full compliance with all relevant legislation.
- Ability to access advice on compliance with waste legislation.

- Ability to access tracking data and importantly, to receive aggregated data for total waste collected from all sites for the company's own reporting requirements.
- Receive help with compliance information and staff training across store branches.

One-to-many distributor-PCS relationships could also raise the administrative burden for distributors. While a clearing house could act as a central hub to distributors in meeting some of the above requirements such as those related to service level, legal and reporting, it cannot substitute direct communication and coordination with a PCS. For example, two B2B wholesalers stressed that the administrative burden to both store managers and headquarters would be significant, if their stores were matched to different PCSs. The wholesalers are concerned that the constructive partnership and tacit knowledge built with their current PCS would be lost. One example shared by the wholesaler is that the current PCS is aware of the store traffic patterns and would turn up at less busy times to ease the stress on store operators. While a newly matched PCS could be informed of this preference, the wholesaler would prefer to minimise such learning curves.

Moreover, some distributors currently have direct control over the chain of custody for WEEE, by either setting up their own treatment facilities or dealing directly with their nominated AATFs and use the resulting evidence notes to offset their obligation with a PCS. Two PCSs engaged in the former category expressed the same view (on separate occasions) that the parent company distributor has no desire to work with other treatment providers when significant investment has been made for in-house vertically integrated operations. This could conflict with the choice of AATFs by the matched PCS based on other criteria such as previous relationship and proximity.

Distributors are also concerned about entrusting their own due diligence and demonstration of chain of custody to a third party (whether to the matched PCSs or to a clearing house). For example, one survey response from a major telecommunications company indicated a strong preference for having only one relationship with a PCS in order to maintain visibility and control of the material handled. The company also raised concern about the evidence notes issued by their nominated AATF being assigned to a PCS not of their choosing (i.e. if a PCS other than the company's tendered PCS is matched to certain sites and claim the resulting evidence notes). In comparison, this particular respondee is less concerned with PCS interactions with DCFs.

If the clearing house is tasked with due diligence of all PCSs and their operators, feedback from one B2B wholesaler emphasised that they would still require assurance that they would not be liable if any PCSs or their operators previously approved by the clearing house turn out to be non-compliant. Two out of eight survey responses from distributors indicated strong concern against the potential of being designated a PCS that may previously lack collection experience, even if there were appropriate checks and balances in place to guarantee compliance and service level; two other responses would accept the arrangement with appropriate assurances, while the remaining four were inconclusive.

Beyond due diligence, one distributor survey response has highlighted that one of the most important decision-making factors related to choosing a PCS is the competence to provide support in improving the company's own environmental performance. For such distributors, being matched to PCSs that are unwilling or unable to provide support on this front (beyond the minimum service level agreement) would be concerning. Another survey response highlighted concern over the credential and experience of matched PCSs in handling confidential information from B2B products.

On the other hand, there are also considerable risks of not including all DCFs in the matching system, especially if a weight-based target is maintained. If WEEE from matched DCFs fall below the targets, then WEEE holders outside of the matching system would be in a position to charge economic rent (i.e. beyond the necessary costs) for the WEEE they hold (although this could be ameliorated through the use of a mechanism like the current compliance fee). PCSs may also collect selectively outside of matching to meet their targets as cheaply as possible, leaving some parts of the country more deprived of collection/treatment services and infrastructure. Although orphaned sites could be included in the matching system as a safety net, it would not address the issue of selective collection which goes against the principle of matching.

One UK PCS presented a countering view that it does not consider the creation of economic rent a likely scenario. To quote, "actual experience over six years, providing collection services to many distributors, has shown us that the perceived risks do not materialise". Furthermore, the PCS attested that across five large distributors and other smaller retailers and wholesalers totalling at over 1,450 collection points across the UK, none has ever requested or received payments for access to WEEE, in spite of the fact that some of the distributors/retailers serviced have their own WEEE obligation.

However it should be noted that this is the experience and view of one PCS with a niche focus on certain WEEE streams, so it may not be representative of other PCSs' interactions with distributors/retailers for other more profitable WEEE streams. Indeed, out of the eight survey responses received from producers and distributors, one response confirmed that rebates are received for access to WEEE; two responses indicated the opposite while the remaining five responses were inconclusive. The risk of economic rent would be more likely with commercially attractive streams such as LDAs. However, since 2014 there has been zero compliance fee for LDAs and, if this is maintained, the risk of economic rent for this stream is already mitigated.

The likelihood and consequence of distributors charging economic rent outside of a matching system relates to how much WEEE they collect and the use or otherwise of an adjusting mechanism such as a compliance fee. Currently, with the exception of LDAs, cooling appliances, and photovoltaic panels, collection from distributors under Regulation 43 does not exceed 5% for any WEEE category (data from 2020 quarter 1-4).[17] While this share may increase as more retailers roll out in-store and other collection channels, collections from LA DCFs are also likely to increase if kerbside collection were mandated. In view of these potential changes in the wider system, a matching system needs to remain flexible during initial implementation.

Overall, feedback from PCSs, B2C distributors, and B2B wholesalers suggests that the priorities of distributors lie in minimising legal risks by ensuring the chain of custody, receiving accurate data on time for reporting, and receiving consistent, high-quality and fuss-free collection and compliance services. Although some distributors are known to receive a rebate for providing WEEE, the environmental and legal risks that ensue if they could not procure any PCS services are far greater. If matching of only LA DCFs does lead to economic distortions, then the scope of matching would need to be extended and system-level interventions would also be necessary.

Between other DCF operators (notably WMCs) and PCSs

[17] Environment Agency, 'WEEE Collected in the UK', GOV.UK, 2020, https://www.gov.uk/government/statistical-data-sets/waste-electrical-and-electronic-equipment-weee-in-the-uk.

Day-to-day operation of DCFs can be either managed in-house (i.e. by the LAs or in some limited cases, by the distributors themselves), or contracted out to WMCs. Especially in the case of a household waste recycling centre (HWRC) network within a LA, there could be one or more contractors managing different sites and services.[18] WMCs, especially the vertically integrated ones whose operations include PCS services and/or AATFs, may be more significantly impacted by matching, at least during the transition period when new working relationships are still being established. There are two major implications, as follows:

First, where it applies, WMCs would lose control over the public tendering process for WEEE management on behalf of LAs. As previously shown in Table 8, two of the 12 recent examples were tendered by a WMC. Although it is unclear how value-added services were delivered, some WMCs may currently benefit from these customised offerings including the aforementioned revenue-sharing arrangements with the contracted PCS. Matching would remove this source of revenue by formalising the scope of value-added services within the remit of PCSs.

Second, a matching system could disrupt the vertically integrated supply chain and the resulting economies of scale and scope achieved by some WMCs. It is possible for one WMC to be responsible for the WEEE collection including kerbside collection of small mixed WEEE (SMW), segregation and consolidation, uplift, all the way to preparing for re-use and recycling of WEEE arising from a DCF that it operates. Even if an algorithm for matching were designed to preserve existing working relationships, matching still introduces the likelihood of a competing PCS being matched to a DCF operated by another vertically integrated WMC. The competing PCS may or may not choose to work with the WMC-operated AATFs, which would result in another lost stream of revenue for the WMC. Furthermore, this disruption to vertical integration could impede logistical efficiency and therefore cause increased carbon emissions and costs for WMCs that operate PCSs, and ultimately their producer members, although these may be offset by improved efficiencies for the system as a whole.

On the other hand, a competing PCS could also face higher risks of denied access or inflated gate fees from WMC-controlled AATFs, especially if there are limited options of AATFs in the assigned area of operation. This is a potential risk noted in the WEEE EPR review[19]; however, the report has declared that there is currently no clear evidence that vertically integrated WMCs in the UK are undertaking anti-competitive practices. The report has recorded other stakeholder feedback related to additional competitive advantages held by a vertically integrated WMC; these include having inside information as to the actual costs of reprocessing, better understanding of the costs and margins related to evidence trading, and automatic obligation for all WEEE it handles. These concerns relate to potential competition law issues and fall beyond the scope of this study.

Between PCSs and subcontractors (notably AATFs)

From a PCS's perspective, a matching system would likely require new partnership development with AATFs as the PCS may not have extensive experience in the matched DCFs. Each new partnership would require resources for management and due diligence. Since the distribution of collection and treatment services is uneven across the UK, some PCSs may face more limited options for subcontractors when weighing up costs, efficiency, and environmental impact.

[18] WRAP, 'Household Waste Recycling Centre (HWRC) Guide', November 2018, https://wrap.org.uk/resources/guide/household-waste-recycling-centres-hwrcs-guide#download-file.
[19] Mark Hilton, Orla Woods, and Alice Johnson, 'Electrical and Electronic Equipment: Ingredients for Successful Extended Producer Responsibility'.

From an AATF's perspective, changes and uncertainty may be expected during the transition period. If the matching system results in disruption of an existing stable relationship with the incumbent PCSs in the region, momentum for investment and innovation garnered from this stability could be disrupted at least in the short term. However, this could recover and reach higher levels under a matching system designed to foster long-term stability in the wider system.

An AATF could be a vertically integrated operation owned/operated by other stakeholders in the sector such as WMCs, PCSs and distributors. As discussed above, currently low-risk revenue streams and efficiencies from vertical integration could be disrupted by a matching system, which has negative implications for both PCSs and AATFs at least in the short term before a new stability could be reached under matching. The level of disruption depends on the scope of matching and the criteria incorporated in the algorithm.

Central coordination of information flows

A central coordination body (a public agency or a separate clearing house) is necessary for administering the matching system. The coordination body, as seen from examples in Section 5.1, could also act as the central hub of information to define a Code of Practice , and to facilitate dispute resolution, collection data reporting and validation, invoicing and other administrative tasks.

The remit of a potential clearing house in the UK could include coordination of a wide range of information in effort to reduce the administrative burden for stakeholders. In this case, the initial investment required to establish the relevant systems would be higher.

Alternatively, the clearing house could oversee only the information essential for matching. At a minimum, this includes: POM data from all PCSs for calculating market shares, tonnages collected by PCSs from each DCF, and tonnages prepared for re-use or treated at AATFs. As one UK PCS highlighted, many PCSs have already invested in and established their own systems for managing client and subcontractor relations as well as data flows. Instead of taking on a wide scope and overhauling these systems, a UK clearing house could instead focus on the key tasks of matching.

The remit of a clearing house could affect administrative organisations in the current system to various degrees. First, the IT infrastructure and administration system for the PBS would become redundant if matching were implemented. Second, the task of calculating PCSs' market shares based on submissions of producer members and their POM data could be transferred from the environmental regulators to the clearing house. Following this, environmental regulators may also task the clearing house with the quarterly reporting of consolidated and validated data for collection and treatment. Last, the clearing house could be responsible for the WEEE Settlement Centre, including the maintenance and potential upgrades of the platform to ensure it remains fit for purpose under a matching system.

6.1.1.3 Influence PCSs' business drivers and approaches to innovation and competition

This section discusses how matching could impact the dynamics of competition and business drivers to innovate, and highlights the wider system conditions that affect the productiveness of matching. The associated barriers to implementation and potential mitigation strategies are elaborated in Section 6.3.

Implication for competition

Matching links a PCS's market share to its access to DCFs likely to collect a certain tonnage of WEEE. This means that matching would allow producers (particularly large ones) to move more easily between PCSs,

thereby increasing competition between PCSs. If a large producer switches between PCSs, it would have a direct and tangible impact for both the incumbent and incoming PCS because it would result in a change in the distribution of pick-up requests, DCFs or geographic areas. It is therefore likely that there would be more pressure on PCSs to continuously improve and innovate to stay competitive. This was an implication highlighted in the 2013 Impact Assessment.[20]

On the other hand, PCSs would receive a baseline guaranteed access to WEEE for every member, which makes it less risky to take on new members. This could again promote competition amongst PCSs. It is important to reiterate that although matching can secure for a PCS access to WEEE proportionate to its market share, the associated efficiency and costs vary by the type of matching and level of sophistication of the algorithm as elaborated in Section 5.3.2.

Implication for collection rates

The 2013 Impact Assessment has highlighted two interconnected concerns over the collection rates[21]. Though the WEEE system has evolved significantly since the Impact Assessment, these concerns were echoed by some LAs, retailers and PCSs during stakeholder engagement. In today's context, both concerns have implications for the current target and compliance fee system:

The first concern is that if matching were implemented together with weight-based targets for PCSs and if the matched tonnages were lower than the targets, then PCSs would be required to find additional WEEE outside of the matching system to meet their targets. This then leads to the potential issue of economic rent discussed in the last section. This is especially problematic if matching included only LA DCFs.

Implementing matching of LA DCFs alongside a weight-based target also has implications for innovation within the UK WEEE system. UK PCSs employ different strategies to meet their obligations. Some focus on LA DCF collection and others establish alternative collection networks with retailers, distributors, logistics and/or their own infrastructure. Some PCSs employ both strategies in parallel. Some PCSs have argued that all PCSs should share out the collection obligation from LA DCFs as these are the primary source for WEEE arising, and are perceived as more expensive to collect. One PCS expressed a countering view that it is unfair to assume alternative collections are cheaper or easier by default, as there are also costs for establishing the infrastructure and network to be considered. Since no cost data are available due to commercial sensitivity, it cannot be judged whether - or by how much - alternative collections hold a cost advantage over LA collections. This argument highlights a current gap in the knowledge of the average full net cost of WEEE managed from different channels. If a policy impact assessment were to be carried out about matching, it would be beneficial to engage a group of PCSs to establish a range of set-up and operating costs for WEEE collection from various channels. This cost comparison would reveal whether LA DCF collections are significantly more expensive, and therefore all PCSs should share out this cost under matching. Nevertheless, it is important that matching and the wider system does not deter PCSs from investing in alternative collection networks and cause the sector to stagnate.

Stakeholders are also concerned that if the algorithm for matching resulted in widespread fragmentation, meaning that various PCSs are matched to a DCF or LA for individual pick-up requests or uplift of separate WEEE streams (for matching by collection points), then PCSs would be more constrained in what they could do to improve collection efficiency. This risk could be minimised by an algorithm for matching as

[20] Daniel Coleman and Graeme Vickery, 'WEEE System Impact Assessment (BIS 0393)'.
[21] Daniel Coleman and Graeme Vickery.

seen in Italy. However, the risk cannot be eliminated, and some PCSs may still face this challenge. This could signal the need for a change of mindset and dynamics of competition in the wider system. PCSs sharing sites may find it mutually beneficial to explore more collaborative approaches. For instance, PCSs may try to coordinate for the same AATF to collect different WEEE streams for the shared site on the same day.

Regardless of whether or how matching could be implemented, the UK WEEE system needs significant improvement in collection performance. Further work is necessary to chart out what interventions are required to drive more collections, and how they could be practically implemented. The interventions should target the wider system, though some of which may have implications for the rules of matching and the role of the clearing house.

6.1.2 Implications considering potential regulatory reforms

Several potential reforms are being actively debated leading up to the 2022 consultation of the UK WEEE Regulations. If implemented, the following implications for the suitability and feasibility of introducing matching should be anticipated.

Establishment and coordination of a central fund aimed at reducing losses of WEEE

During a stakeholder discussion with members of the Industry Council for Electronic Equipment Recycling (ICER), it was raised that there have been on-going discussions of establishing a central fund for initiatives that reduce losses of WEEE, such as funding LAs for kerbside collection. This could ease some LAs' concern about loss of revenue and support from PCSs under matching. Coordination of such a fund could fall within the remit of the clearing house.

Evolving role of distributors collections

Retailers are likely to play an evolving role in collection with the wider roll-out of in-store collections outside the Distributor Take-back Scheme (DTS). The current Phase 5 of DTS runs from 1 January 2020 to 31 December 2021. Due to the pandemic, it is well-acknowledged that the in-store collections have been operational for only a limited amount of time and the level of collections from participating locations is still uncertain. If the matching system includes in-store collections or delivery hubs (after back-hauling WEEE from stores), then there is risk of frequent re-allocation of sites or significant financial clearing at least in the short term. This is because the expected tonnages from matched stores/hubs may fluctuate and deviate from the PCSs' share of obligation. Furthermore, as highlighted previously, the matching system should be designed to minimise disruption to the existing range of reverse logistic systems, minimise administrative burden to distributors, and provide guarantees around compliance with waste duty of care. If matching excludes distributor collections, then either within the matching system or as part of the wider system reform, there should be mechanisms (akin to the current Compliance Fee) to prevent the creation of an economic rent for WEEE collected by distributors, potentially driven by the need for PCSs to achieve a specific weight-based collection target.

Potential introduction of kerbside collection

Kerbside collection is another policy initiative that has gained significant stakeholder interest. Kerbside collection would have a significant effect on the design of an algorithm for matching and its implementation, most notably concerning the interactions between LAs and PCSs. There are three aspects to consider:

- Tonnages from kerbside collections consolidated at different facilities (e.g. HWRCs, WMC/council depots and waste transfer stations) would need to be included in the matching system, unless the LA opted to self clearance and treatment for certain streams;
- The way kerbside collected tonnages could be included in matching depends on how kerbside collection would be implemented across the UK. Since these collections would be managed by WCAs rather than WDAs, it means that:
    - If a kerbside collection system required WCAs to physically transfer the tonnages to WDA-managed DCFs, then an algorithm for matching would operate at a WDA-level and the offtake of WEEE would remain between WDAs and the matched PCSs;
    - If the kerbside collection tonnages are not consolidated at the level of WDAs, then PCSs could be expected to work with WCA-managed DCFs where WEEE collected from kerbside collections would be consolidated. With or without matching, this would represent a significant change for PCSs as many of them do not currently liaise with WCAs. If matching were to be brought into the picture, then an algorithm for matching would need to include both WDA- and WCA- managed DCFs. This is expected to significantly complicate the process of designing an algorithm for matching, since it would be necessary to evaluate the tonnages arising per stream, logistical complexity and cost differentials for both WDA- and WCA-managed DCFs. If kerbside collection and matching were introduced at the same time, there would be significant uncertainty in the volumes arising and therefore risk of failing to match PCSs to LAs fairly, especially with regards to a PCS's share of obligation in SMW. Consequently, the early phases of matching would likely be highly unstable because the matching arrangements would evolve as kerbside collection data build up. Overall, if kerbside collection remains totally managed by WCAs, then more investment should be expected for designing and operating a more complicated algorithm for matching.

Potential changes to targets

From discussion with stakeholders, potential reforms to the UK-wide and possible PCS targets are being discussed to better align the system outcomes with circular economy best practice. Though no specific options have been listed, potential examples include targets on collection point density, losses from the system (e.g. tonnages of WEEE in residual waste), consumer knowledge and attitude about WEEE re-use and recycling, etc.

A matching system can be designed to be compatible with different types of UK-wide and/or PCS targets, or indeed no targets at all. It is out of the scope of this project to determine what types of targets, if any, would best suit the UK WEEE system.

6.2 Benefits and drawbacks of matching approaches in the UK context

This section first lays out the key areas of interest from each stakeholder group's perspective, as well as the common interests and aspirations for the UK WEEE system. This map of stakeholder interests is then used in three ways to facilitate the feasibility analysis:

1. Identify, if any, market failures and areas of improvement within the current system. This then feeds into analysis of whether and how matching could benefit the UK system, whether there are alternative solutions to matching for the identified problem areas;
2. Compare the benefits and drawbacks of each method and evaluate their appropriateness in the UK context, accounting for potential trade-offs and unintended consequences;
3. Identify the method(s) that are the most appropriate for the UK, to focus the following analysis on barriers to implementation (Section 6.3) and the costs and benefits to stakeholders (Section 6.4).

6.2.1 Problematic areas in the current system and the opportunity for matching

The purpose of matching, and the potential benefits it could deliver in today's context, is profoundly different from when matching was last evaluated in 2013 as an option to solve a significant system failure. Throughout engagement with UK stakeholders, none of the stakeholders think the current system is critically dysfunctional akin to the pre-2013 situation, however the consensus is that there is significant room for improving the system performance and driving higher collection.

Many stakeholders have questioned the problems that matching is intended to solve. To this end, Table 9 summarises the common and stakeholder-specific interests gathered from a mix of desk-based research and stakeholder interviews, as well as evidence and stakeholder feedback on how satisfactory the current system is in meeting these interests. Aspirations linked to potential future reforms in the system have also been incorporated to evaluate whether the current system is fit to deliver on these aspirations. In later sections, different types of matching are evaluated against the identified shortcomings to determine whether and how matching could benefit the UK system. Note that entries in the table are not in order of priority.

Table 9 Key stakeholder interests and view of the current UK WEEE system

Stakeholder interests		**Stakeholder's level of satisfaction with the current system**
Green colour coding represents core interests within the system	Blue colour coding represents aspirations linked to potential future reforms	**Low:** more than one stakeholder indicated there is a significant system failure **Low-moderate:** more than one stakeholder indicated dissatisfaction with the current system, highlighting real and relevant shortcoming(s) **Moderate:** only one stakeholder indicated dissatisfaction / there are conflicting views on the highlighted shortcoming(s) **Moderate-high:** more than one stakeholder indicated the current arrangements is functioning but could be improved **High:** more than one stakeholder indicated they are satisfied with the current arrangement **Unknown:** no data available / conditioned upon future changes in the system and stakeholders have not provided any speculation
A. Common interests		
A.1 Standardise and improve service level of WEEE collection and treatment across the UK		**Low-moderate:** No stakeholders have raised significant system failures. There are conflicting views about the service level under PBS. Proponents (one English LA and several PCSs) felt that the PBS served its purpose, and the service level is sufficient, while some LAs and AATF members felt that the shorter-term arrangements under PBS prevent further stability in the system. However, the PBS is nevertheless much more stable than the default under the regulations - which is for LAs to make a new request, via regulation 42, on each occasion that they have a stream of WEEE for collection. A more notable shortcoming as indicated by multiple PCSs is that there is a lack of consistency and standardisation for contract terms for accessing WEEE from LA DCFs. For example, one PCS has received contract terms that were specified by a LA on a take-it-or-leave-it basis; another PCS has come across some contract terms that are not commercially viable and decided not to bid as a result. These PCSs have called for more consistent service level agreements across the UK. Lastly, PCSs have also pointed out that lack of standardisation in LA contract terms adds to the resources expended to prepare responses. One PCS has estimated that it could take up to the equivalent of 1 full-time employee to prepare public tenders for WEEE each year. Considering that multiple PCSs typically bid, this represents a source of inefficiency and duplicated cost in the WEEE system.
A.2 Reduce administrative burden and complexity for all stakeholders		**Low-moderate:** Multiple stakeholder groups have highlighted sources of administrative burden or complexities that they do not see as warranted or beneficial.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
	LA representatives emphasised that it is easier for them to have only one point of contact for WEEE. Currently, more than one PCS can serve a site for different WEEE streams due to the existence of the PBS. While the PBS serves an important function in the current system, it also introduces inefficiency and administrative burden. For PCSs, the most notable administrative burden is in the LA tender response stage, as explained in A.1. AATF stakeholders have highlighted that they rely on informal relationships and short-term service agreements which hinder improvements to collection efficiency and long-term investment in assets. Stakeholders regarded the current frequent changes in DCF-PCS relationships (under contract and more notably under the PBS) as a major source of uncertainty and administrative burden for activities such as data validation, reporting and invoicing.
A.3 Facilitate long-term stability in the system	**Low-moderate:** Multiple stakeholder groups emphasised a lack of stability in the current system. As discussed in A.2, LA stakeholders felt that long-term and 1-to-1 relationships could reduce administrative burdens. LA stakeholders also point to other potential benefits as a result, such as better understanding of local operational needs, foundation for innovative approach for collection and/or for re-use. There are conflicting views among PCSs about the stability of the current system. Some PCSs noted that the current system is relatively stable as the incumbents are likely to extend the existing contracts or win the new ones. Indeed, anecdotal evidence from two PCSs suggest that some PCSs have maintained long-running relationships with at least some of the LAs. However, Eunomia's EPR study in 2020 has also indicated that some PCSs felt the 1-2 year average contract length is too short and deters innovative approaches.[22] As discussed in A.2, AATF stakeholders emphasised that the current system results in frequent changes which deters PCSs from establishing long-term contracts (e.g. minimum 3 years) with AATFs. This further hinders AATFs' investment in logistics and processes. Additionally, AATFs are exposed to logistical inefficiencies and hence costs resulting from 1-to-many and changeable relationships between DCFs and PCSs under the PBS.

[22] Mark Hilton, Orla Woods, and Alice Johnson, 'Electrical and Electronic Equipment: Ingredients for Successful Extended Producer Responsibility'.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
A.4 Ensure existing and potential future regulations are enforceable	**Moderate-high:** No stakeholders have raised concerns about enforcement of existing rules. However, it should be noted that stakeholders see this as an important foundation for any potential future reforms to the system.
A.5 Increase total collection quantity, and reduce losses from the system	**Low-moderate:** Multiple stakeholders across the board have expressed dissatisfaction with the current level of collection as manifested in the missed targets and the level of compliance fee. Stakeholders have emphasised that increasing collection should be the primary goal for future reforms of the WEEE system. Therefore, a matching system should only be implemented if it a) does not hinder collection and more importantly b) could be implemented in such a way that brings a positive (direct or indirect) impact to collection quantities.
A.6 Improve the quality of collections in support of re-use and higher value retention from WEEE	**Moderate:** Policy makers as well as many PCSs that engaged with this study have put this as another priority for the future of the UK WEEE system. While no stakeholder criticised the current re-use system, it should be noted that issues raised by LAs, PCSs and AATFs in A.1 and A.3 can be seen as barriers to higher re-use and value retention from WEEE. Indeed, recent research published by Material Focus has demonstrated that UK WEEE arising presents a significant opportunity for retaining the economic and environmental value in critical raw materials.[23]
A.7 Ensure the targets and other system-level incentives are aligned with circular economy	**Moderate-high:** While no specific shortcomings were flagged by the stakeholders, multiple PCSs have indicated that system-level changes are necessary to drive greater collection (A.5) and circularity (A.6).
A.8 Ensure national coverage of WEEE collection (via multiple channels including potentially kerbside collection) and treatment	**Moderate-high:** A majority of the stakeholders agrees that the PBS has been an effective solution to ensure national coverage of LA DCFs. However, two stakeholders on separate occasions argued that PCSs should also be driven to expand the collection network.

[23] Giraffe Innovation and Swansea University, 'Contributing towards a Circular Economy Utilising Critical Raw Materials from Waste Electricals', Recycle Your Electricals, July 2021, https://www.recycleyourelectricals.org.uk/report-and-research/contributing-towards-a-circular-economy-utilising-critical-raw-materials-from-waste-electricals/.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
A.9 Improve the efficiency and reduce the environmental impact of the overall system	**Moderate:** There are conflicting views about how efficient the current system is. It is recognised that most PCSs have a stronger presence in some regions than in others. From the mapping of the current LA DCF contracted PCSs, there is potentially regional synergy. One PCS indicated that WEEE collection benefits from regional synergy as it typically occurs via a 'milk round' (i.e. multiple stops on one route) visiting several DCFs. However, some AATF stakeholders have indicated that, since many PCSs can collect from the same site (under the PBS), AATFs can incur higher than necessary logistical costs as well as environmental impact in the few sites serviced by the PBS.
B. Producers	
B.1 Costs better reflect the true cost of compliance for producers	**Moderate:** As elaborated in Section 6.1.1.1, many PCSs flagged the bespoke arrangements in some LA contracts as problematic. PCSs have argued that the cost of preparing for and delivering on certain bespoke arrangements, which are ultimately paid by producer members, is not compatible with the full net cost principle. PCSs, representing the interest of their producer members, have flagged this as especially concerning in anticipation of other potential reforms that are likely to increase the necessary producer costs (e.g. kerbside collection, infrastructure investment). In the current system, competition for access to WEEE can inflate the cost of evidence to producers. PCSs that are unable to collect enough WEEE in certain categories to meet their obligations may need to purchase evidence notes or pay a compliance fee. While one PCS indicated that the evidence notes are sold at break-even prices, it is possible that some PCSs charge a higher price than the actual cost of collection and treatment incurred, though the margin is unknown due to commercial sensitivity. There was a conflicting view from one major PCS. The PCS pointed out that under the current competitive tender system, PCSs can concentrate on collecting a specific stream or focus operations in a specific area of the country to drive economies of scale. The PCS is concerned that replacing this with a matching system could increase costs without necessarily increasing collection rates.
B.2 Have option and bargaining power to switch PCSs for the best service	**Moderate-high:** There were no specific producer complaints of their PCSs other than one retailer indicating that the current system needs improvements in efficiency and simplicity. Three retailers indicated in their written responses that, in principle, they would support changes in the system that facilitate mobility of producers. One PCS has highlighted that this is more of concern for big producers with large obligations.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
C. Distributors (including retailers)	
C.1 Costs better reflect the true cost of compliance (for distributors who are also producers)	**Low-moderate:** Same as B.1. In addition, one retailer indicated that the PBS could incur additional cost at no discernible benefit. For example, the retailer has been required to share the cost of collection under the PBS for one category for which it has met its obligation via its scheme.
C.2 Have option and bargaining power to switch PCSs for the best service	**Moderate-high:** Same as B.2 above.
C.3 Existing functioning collection and take-back systems are not disrupted or disincentivised	**Moderate-high:** While stakeholders did not specify shortcomings relating to distributor collection, this was indicated by two retailers undertaking a significant level of collection as a general concern of future reforms.
C.4 Ensure that all tonnages collected from customer doorsteps and in-store count towards the distributor's own obligation (via its PCS)	**Moderate-high:** Stakeholders did not raise any significant shortcomings in this aspect. One retailer flagged that the current system sometimes results in unsold evidence notes for certain categories where there is a surplus volume of collected tonnages, and retailers may not be able to fully claim the benefit of their collections. Although this could deter distributors to a degree, there likely exist financial incentives for distributors to collect beyond their obligation since certain WEEE categories (such as LHA and some SMW products[24]) are revenue-positive.
D. Producer Compliance Schemes	
D.1 Encourage healthy and fair competition amongst PCSs for producer members	**Low-moderate:** Two PCSs indicated that they would like to see PCSs focus more efforts on competing for producers rather than competing for access to WEEE beyond their market share requirements. One PCS explained that it is currently extremely difficult for a PCS to provide accurate and commercially attractive price proposals to a large producer without taking on excessive commercial risk. It is hypothesised that PCSs that have larger financial reserves, e.g. from other waste management or compliance operations, are more likely to take on higher commercial risk. The

[24] Mark Sayers, 'Evaluating Opportunities to Establish an Investment Fund for WEEE Infrastructure', March 2021, https://www.recycleyourelectricals.org.uk/report-and-research/a-weee-infrastructure-fund/.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
	PCS has also highlighted that any collection arrangements released by a producer's current PCS would likely be the most costly ones they have.
D.2 Future-proof the system: potential changes to the system need to be compatible with kerbside collection (in case it was mandated) and supports relationship-building with WCAs	**Moderate:** Though at the time of writing the consultation has yet to take place, several PCSs have speculated that kerbside collection is likely to become mandated and some AATF stakeholders have also voiced support as it is seen in support of greater collection quantities (A.5). However, multiple PCSs have also voiced concern that with this anticipated increase in cost to producers, future reforms should look for ways to improve efficiency and potentially eliminate unnecessary cost elsewhere in the system. Other potential reforms should also consider the implication and involvement of WCAs.
D.3 Retain flexibility to choose suppliers and partners and retain the resulting revenue (if the PCS is vertically integrated)	**Low-moderate:** Eunomia's WEEE EPR review has documented stakeholder views that vertical integration poses challenges to fair competition for access to WEEE and transparency.[25] This view is echoed in stakeholder responses to this project.
D.4 Encourage fair competition of PCSs: require and allow more PCSs to undertake physical collections according to their members' obligation requirements	**Low-moderate:** Eunomia's WEEE EPR review has pointed out that by having many PCSs that do not undertake physical collection as their main method to compliance, the UK WEEE system has duplicated overhead and staff costs to producers.[26] One PCS holds the view that, as the WEEE system has so far relied on LA DCFs, more PCSs should participate in physical collection and be driven to improve and expand their collection network. The PCS also supports the view that PCSs' access to WEEE should be proportional to their market share to minimise the need to purchase evidence notes.
D.5 Encourage fair competition of PCS: require all PCSs to undertake collection from both low- and high-cost areas	**Moderate-high:** Based on the view of some PCSs and LA stakeholders, the PBS has been an effective solution to ensure PCSs cover all Regulation 34 requests from LA DCFs. PCSs have pointed out that the number of LAs and streams of WEEE managed under the PBS has been declining, meaning more LAs and WEEE streams have entered bilateral agreements with PCSs.

[25] Mark Hilton, Orla Woods, and Alice Johnson, 'Electrical and Electronic Equipment: Ingredients for Successful Extended Producer Responsibility'.
[26] Mark Hilton, Orla Woods, and Alice Johnson.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
E(a). Waste Disposal Authorities	
Ea.1 Retain flexibility in defining the terms of contract and level of assurance from the chosen partners	**Moderate:** LA stakeholder feedback (those outside of the PBS) indicate that the current system generally meets their priority of having reliable, quality service. They have flexibility to define the service level agreement and ensure measures are put in place for any service failings. As noted previously, hidden costs for value-added services beyond the full net cost are contested by PCSs.
Ea.2 Retain flexibility for self clearance and treatment and to retain the resulting revenue (if operates DCF in-house)	**Unknown:** Based on private correspondence with Defra, at the time of writing there is no self treatment. It is assumed that WDAs that operate their own DCFs would like to retain this flexibility.
Ea.3 Retain on-going investments for operational and infrastructural improvements	**Moderate:** There are conflicted views. One LA indicated that it views social value as a standard part of waste management service agreements. One PCS has indicated that it thinks PCSs can continue to provide social value if they are clearly defined and standardised nationally.
E(b). Waste Collection Authorities	
Eb.1 Have flexibility in defining the terms of contract and level of assurance from the chosen partners	**Unknown:** These are assumed as relevant points of interest for WCAs if they were to take primary responsibility for arranging for kerbside collection of electricals.
Eb.2 Have flexibility for self clearance and treatment and to retain the resulting revenue	
Eb.3 Receive on-going investments for operational and infrastructural	

Stakeholder interests	Stakeholder's level of satisfaction with the current system
improvements for kerbside collection (if mandated)	
F. Waste management contractors	
F.1 Retain flexibility to choose partners and to retain the resulting revenue (if the WMC is vertically integrated)	**Moderate:** Based on stakeholder engagement, WMCs indicated they prefer to retain this flexibility and avoid situations where competing PCSs may receive the evidence notes for the WEEE they have managed at DCFs. Though, as discussed previously in Section 6.1.1.2, some PCSs have contested that vertically integrated PCSs create unlevel playing fields.
F.2 Retain flexibility for self clearance and treatment and to retain the resulting revenue (if operating local authority DCFs)	**Unknown:** Based on private correspondence with Defra, at the time of writing there is no self treatment. It is reasonable to assume that WMCs would like to retain this option.
F.43 Option to allow self clearance and treatment of SMW from kerbside collections consolidated at WMC-operated depots	**Unknown:** Based on private correspondence with Defra, at the time of writing there is no self treatment. It is reasonable to assume that WDAs that operate their own DCFs would like to retain this option.
F.4 Minimise disruption to existing logistical arrangements for WEEE (concerning e.g. asset management, route planning, scheduling, etc.) so as to maintain/improve efficiency	**Moderate-high:** From WMCs' perspective, current contract arrangements are functioning as they are able to build local knowledge and schedule services accordingly.

Stakeholder interests	Stakeholder's level of satisfaction with the current system
G. Third sectors[27]	
G.1 Improve access to reusable EEE and retain revenue	**Unknown:** These are assumed core interests, but no stakeholder response was obtained in this study.
G.2 Minimise disruption to existing logistics arrangements for preparation for re-use so as to maintain/improve efficiency	
H. Approved Authorised Treatment Facilities	
H.1 Existing initiatives for improvement and innovation are not disrupted/ deterred	**Low-moderate:** As discussed previously in Section 6.1.1.2, AATF stakeholders have pointed out that current operations are based on informal relationships which are prone to disruption and deter investment.
H.2 Minimise disruption to existing logistical arrangements for WEEE (recycling and preparation for re-use) so as to maintain/improve efficiency	**Low-moderate:** As discussed previously in Section 6.1.1.2, AATF stakeholders have indicated that current logistics arrangements lack efficiency, and this is exacerbated by instability in the system.
H.3 Maintain currently secure supply of WEEE (if the AATF is vertically integrated)	**Low-moderate:** AATF stakeholders have indicated that supply of WEEE is currently unstable. One retailer that also owns its own AATF facility has indicated the importance for that secure chain of evidence to be maintained so that the retailer's own obligation can be met.

[27] Third sector refers to non-governmental and non-profit organisations or associations, including charities, voluntary and community groups, social enterprises, etc. Source: https://www.nao.org.uk/successful-commissioning/introduction/what-are-civil-society-organisations-and-their-benefits-for-commissioners/

Stakeholder interests	Stakeholder's level of satisfaction with the current system
I. Environmental regulators and government	
I.1 Harmonisation across nations regarding approach to WEEE management	**Moderate-high:** No significant shortcomings have been highlighted regarding environmental regulators. One PCS noted that the current definition for used EEE differs across nations. Harmonisation of definitions and other aspects such as stakeholder responsibilities also applies to any future changes to the system.

6.2.2 *Matching by pick-up request*

Table 10 Pros and cons of matching by pick-up request in the UK context and alternative solutions

Stakeholder interests (level of satisfaction with the current system)	**Benefits/Drawbacks and potential trade-offs**	**Are there alternative solutions to matching for the identified shortcomings?**
	--: Overall significant drawback -: Overall minor drawback +/-: Limited/unknown/uncertain overall impact to the system +: Overall minor benefit ++: Overall significant benefit	
A. Common interests		
A.1 Standardise and improve service level of WEEE collection and treatment across the UK **(Low-moderate)**	**+/-:** Matching by itself does not automatically improve this aspect of the UK WEEE system. This is in fact a pre-requisite for matching of any kind to work in the UK context since this provides a level playing field for PCSs and assurances for LAs.	Yes, guidelines and minimum criteria for contract terms can be developed without matching.
A.2 Reduce administrative burden and complexity for all stakeholders **(Low-moderate)**	**--:** For LAs, pick-up requests would be coordinated by a clearing house and therefore the LAs would have a single point of contact. The potential downside is that DCF operators could interface with different PCSs for each pick-up request, which could cause administrative and operational inefficiencies especially in the early phases when some PCSs may lack local experience. For PCSs and their subcontractors, the need to respond to ad hoc pick-up requests from various locations would make costs variable throughout the year and difficult to forecast. This would make it challenging for PCSs to offer members a fixed price without taking on excessive risks. Matching by pick-up request would also require PCSs to have arrangements and relationships in place to cover from any location in the UK (or in a given devolved nation depending on the system design). This creates an administrative burden in terms	Yes, initiatives can be introduced under the current system. This could include: • Continue to monitor the scale of PBS to require actions if it creates an increasing fragmentation of DCF-PCS relationships. • Improve/invest in IT systems and platforms to streamline the flow of data (e.g. for collected and treated tonnages, evidence notes).

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
	of developing and maintaining these relationships that could be infrequently called upon. This could also lead PCSs to work with less-committed subcontractors, creating risks of mis-reporting that would need to be addressed by the PCSs. For AATFs, this could create additional burden for record keeping and data validation for evidence notes. This risk could be mitigated by a clearing house that liaises amongst stakeholders (e.g. setting and enforcing a code of practice for each actor) and coordinates the flow of information (e.g. a central IT platform for pick-up request, data validation, evidence issuance, invoicing).	
A.3 Facilitate long-term stability in the system **(Low-moderate)**	**--:** Matching by pick-up request is considered by most UK stakeholders as the least preferred option as it could result in a highly dynamic and transactional relationship between PCSs and LAs. This in turn exacerbates issues faced by AATFs relating to informal and short-term arrangements with PCSs. Furthermore, LAs and PCSs have indicated this method could also hinder re-use operations which build on local knowledge and partnerships. A clearing house would have limited ability to mitigate these risks without being overly prescriptive and potentially being anti-competitive.	Yes, guidelines on minimum contract lengths, extension criteria and periods could be established without matching.
A.4 Ensure existing and potential future regulations are enforceable **(Moderate-high)**	**+/-:** No direct impact from matching on this aspect. A prospective clearing house could take on the primary role of regulation enforcement with oversight from environmental regulators	N/A, this is not an issue in the current system.
A.5 Increase total collection quantity, and reduce losses from the system **(Low-moderate)**	**--:** There is concern among stakeholders that this method of matching could lead to less overall collection because of issues listed in A.3. Additionally, there is risk that individual PCSs would be	Yes, separate policy initiatives could be implemented with or without matching, including but not limited to:

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
	demotivated from helping to improve and expand the local collection network. LAs could also lose the other forms of support they currently receive from PCSs (e.g. data analysis, consulting, etc.).	• National communications campaigns; • Central fund for reducing losses of WEEE; • Mandatory kerbside collections; • Expanding requirements for retailer take-back in store and on delivery; • Requiring action in areas where collections consistently fall significantly below nationally expected levels for that socio-geographic region.
A.6 Improve the quality of collections in support of re-use and higher value retention from WEEE **(Moderate)**	**+/-:** Matching is unlikely to impact quality of collection. The quality of used EEE or WEEE depends on the condition at disposal, method of collection between households to DCFs, and level of sorting occurring at DCFs and/or AATFs. Matching does not interfere with this part of the system.	Yes, separate policy initiatives could be introduced without matching, such as: • Introducing a target for preparation for re-use; • Prioritising re-use initiatives when approving funding to LAs; • Requiring sorting of used EEE and WEEE for items collected from kerbside.
A.7 Ensure the targets and other system-level incentives are aligned with circular economy **(Moderate-high)**	**+/-:** Matching can be designed and implemented in a way that is compatible and supportive of different types of targets.	Yes, other policy initiatives relating to targets and incentives can be introduced without matching.
A.8 Ensure national coverage of WEEE collection (via multiple channels including potentially kerbside	**+:** Matching of any kind would ensure national coverage. Matching by pick-up request could be designed to account for requests from WCAs for consolidated collections from the kerbside.	Yes, there is an option to maintain the current system.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
collection) and treatment **(Moderate-high)**		
A.9 Improve the efficiency and reduce the environmental impact of the overall system **(Moderate)**	**--:** Most of the UK stakeholders view this method of matching as the least logistically efficient and environmentally friendly. This is because pick-up requests from DCFs (both LA and retail) are likely to be on an ad hoc basis, leaving limited room for PCSs and their subcontractors to plan and optimise the transportation. This could be exacerbated if pick-up requests were raised per WEEE fraction. Furthermore, it is difficult to predict which PCSs would be assigned to respond to the request, as it would depend on each PCS's progress towards its obligation which includes PCSs' tonnage collected outside of the system (e.g. retail and dual-use collection)	Yes, separate initiatives could be implemented without matching. For example, by encouraging longer public contracts, AATFs and WMCs could have greater certainty in the quantity and origin of supply for planning and optimisation. Managing the scale of PBS could also limit separate collections arranged by different PCSs for the same site.
B. Producers		
B.1 Costs better reflect the true cost of compliance for producers **(Moderate)**	**+/-:** Once implemented, matching of any kind could result in several cost savings for producers: • PCSs could free up the resources currently expended in preparing tender responses, and in attempting to match members' obligations with the PCS's own contracted collection requirements. • PCSs could free up the resources currently expended in designing and delivering bespoke arrangements as they would be replaced by standardised service level agreements. • If other policy instruments such as the evidence notes and compliance fees are kept in place, PCSs would reduce their exposure to fluctuating cost of evidence notes, compliance fee, and PBS fees, over which PCSs have limited control. However,	Yes, separate initiatives could be implemented in the current system to address the shortcomings stakeholders have raised in this aspect. For example, guidelines on the inclusion of social value and other types of added value in contract terms can be established without matching.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
	the level of benefits and potential unintended consequences, depends on other elements of the broader WEEE system. • Potential reduction in number of PCSs that can meet the minimum service level agreements necessitated by matching, and hence the duplicated overheads. • All costs and revenues associated with the collections would pass to PCSs in line with the full net cost principle. It must be highlighted that the above benefits would be countered by additional costs in collection infrastructure. As previously discussed, matching by pick-up request may force every PCS to establish a UK-wide network of subcontractors, which means duplication of resources expended and additional costs to producers. Furthermore, a significant overhaul of WEEE management assets (e.g. skips, bins, transportation vehicles) would be required to make this method of matching operationally feasible. Throughout stakeholder engagement, there has been no evidence that these investments would lead to operational cost saving. Indeed, most stakeholders expressed concern that transportation costs would increase since 'milk round' collections would be replaced with dedicated trips.	
B.2 Have option and bargaining power to switch PCSs for the best service **(Moderate-high)**	**-:** For large producers with high obligation, PCSs may not be able to provide a more competitive cost per tonne of obligation due to the uncertainty in collection location.	
C. Distributors (including retailers)		

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
C.1 Costs better reflect the true cost of compliance (for distributors who are also producers) **(Low-moderate)**	Same as B.1.	Same as B.1.
C.2 Have option and bargaining power to switch PCSs for the best service **(Moderate-high)**	Same as B.2.	Same as B.2.
C.3 Existing functioning collection and take back systems are not disrupted or disincentivised **(Moderate-high)**	**+/-:** Regardless of the method of matching, a matching system would not impact existing retailer operations if the tonnages collected from retailer DCFs, and stores are not matched to any PCSs and instead covered by contracts. **--:** As elaborated in Section 6.1.1.2, the matching system could significantly disrupt the existing relationships and reverse logistic operations, causing concerns in aspects such as higher administrative burden, less bespoke services, and less control/visibility over the chain of custody for WEEE compliance.	N/A, not an issue in the current system.
C.4 Ensure that all tonnages collected from customer doorsteps and in-store count towards the distributor's own obligation (via its PCS) **(Moderate-high)**	Similar to C.4, the impact depends on the scope of the matching system and is independent of the method of matching.	N/A, not an issue in the current system.
D. Producer Compliance Schemes		

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
D.1 Encourage healthy and fair competition amongst PCSs for producer members **(Low-moderate)**	**-:** As discussed in Section 6.2.1, competition for large producers is constrained and occurs on an unlevel playing field in the current system. While matching by pick-up request can deliver PCSs their fair share of WEEE arising from LA DCFs, the costs of collection from different locations may not be fairly distributed among PCSs. As a result, the costs to evidence could fluctuate and financial budgeting would become onerous. It is possible that matching by pick-up request would make large producers even more hesitant to switch PCSs since there is no clear benefit of doing so.	Yes, but alternatives are limited. Some measures could indirectly encourage PCS competition for producers by levelling the playing field. For example, by standardising the terms of contract (including service level and added value), PCSs could compete more fairly for access to WEEE which in turn affects their quotes and offerings to interested parties. Matching remains the most straight-forward mechanism to ensure that producer membership has material effects on PCSs.
D.2 Future-proof the system: potential changes to the system need to be compatible with kerbside collection (in case it is mandated) and support relationship-building with WCAs **(Moderate)**	**+:** Matching by pick-up request could adapt to incorporate kerbside collection relatively easily, once the matching system and the surrounding infrastructure (e.g. clearing house, IT) have been established. WCAs participate in clearing house systems and issue pick-up requests for consolidated kerbside collection. Since most of the kerbside collection is likely to follow a fixed schedule, there is potential to adapt the algorithm and response time requirements for pick-up requests to allow PCSs to respond to both WDA and WCA requests on one trip.	N/A, potential changes to the current system for kerbside collection is out of the scope of this project.
D.3 Retain flexibility to choose suppliers and partners and retain the resulting revenue (if the PCS is vertically integrated) **(Low-moderate)**	**--:** Matching by pick-up request would remove the flexibility for PCSs to choose which LAs (and potentially retailers if included in scope) they would like to work with. More importantly, matching by pick-up request could constrain PCSs' choice of collection and treatment partners. Collection and treatment services are unevenly distributed in the UK, meaning that some service providers could exploit their monopolistic/near-monopolistic positions. PCSs may also have less	Yes, the issues with vertically integrated PCSs could be addressed without matching. This could be raised as a policy initiative for Defra to review and consult with stakeholders.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
	confidence in working with subcontractors on a transactional basis with no incentive for relationship development and improvement.	
D.4 Encourage fair competition of PCSs: require and allow more PCSs to undertake physical collections according to their members' obligation requirements **(Low-moderate)**	**++:** Matching of any kind would require all PCSs to participate and develop the collection network, although PCSs with very small market shares may be allowed to meet their collection responsibility solely by contracting a larger PCS. PCSs that do not participate in collection would no longer be qualified, and the overhead costs associated with these PCSs would be saved.	Yes, separate policy initiatives could be implemented in the current system. For example, the (re)qualifying conditions for PCSs could be modified to preclude PCSs from paying out their obligation. All PCSs with B2C obligation could be required to participate in physical collection either through a PCS's own arrangements or by contracting another PCS to collect on their behalf.
D.5 Encourage fair competition of PCS: require all PCSs to undertake collection from both low- and high-cost areas **(Moderate-high)**	**+:** Existing examples of matching by pick-up request do not explicitly distribute out cost differentials fairly to all PCSs; instead, the algorithm for matching by pick-up request assumes that all PCSs have equal chance of benefiting from a low-cost collection as well as being exposed to a high-cost one. Potential adjustments to address this problem in the UK has been suggested earlier in Table 7.	No, this is a distinct purpose and result of matching.
E(a). Waste Disposal Authorities		
Ea.1 Retain flexibility in defining the terms of contract and level of assurance from the chosen partners **(Moderate)**	**-:** There could be a minor drawback as during the transition period there could be inconsistencies of service levels. As matching by pick-up request would mean a major change in how PCSs organise collection and treatment, the transition period could be more extended and turbulent compared to other methods of matching. Based on available feedback from LA representatives, reliable quality service and assurances in cases of failings are paramount to	N/A, not an issue in the current system. Measures for standardising added value in contracts have been discussed previously.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
	the LAs. Therefore, if adequate service level agreement is established and appropriate contingencies are in place, LAs would not necessarily oppose the concept of matching. (Note that this may not fully represent LA perspectives, as only three LAs engaged with this study.)	
Ea.2 Retain flexibility for self clearance and treatment and to retain the resulting revenue (if operates DCF in-house) **(Unknown)**	**+/-:** A matching system can allow DCF operators to opt out for self treatment, as seen in practice in other territories.	N/A, not an issue in the current system.
Ea.3 Retain on-going investments for operational and infrastructural improvements **(Moderate)**	**-:** Bespoke arrangements in current contracts, such as revenue-sharing agreements, would be standardised. This risk could be partly addressed in developing the UK-wide service level agreement, but some DCF operators may face a dip in WEEE-associated revenue.	Yes, investments to LA DCFs could be maintained and indeed improved in the current system without matching, for example through a central fund aimed at reducing losses of WEEE.
E(b). Waste Collection Authorities		
Eb.1 Have flexibility in defining the terms of contract and level of assurance from the chosen partners **(Unknown)**	**-:** Same as Ea.1 except WCA's service procurement would focus on waste haulage rather than uplift.	N/A, these aspects relate to kerbside collection which could be implemented with or without matching. As discussed in Table 7, matching can adapt to kerbside collection.
Eb.2 Have flexibility for self clearance and treatment and to retain the resulting revenue **(Unknown)**	**+/-:** Same as Ea.2	

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
Eb.3 Receive on-going investments for operational and infrastructural improvements for kerbside collection (if mandated) **(Unknown)**	**+/-:** Funding provided to WCAs for kerbside collection could occur with or without matching.	
F. Waste management contractors		
F.1 Retain flexibility to choose partners and retain the resulting revenue (if the WMC is vertically integrated) **(Moderate)**	**--:** As previously discussed in Section 6.1.1.2, WMCs are likely to lose revenue streams from bespoke arrangements that may be provided under existing contracts. More importantly, WMCs would no longer be able to ensure that all the WEEE it handles would result in evidence notes for themselves, as competing PCSs could be assigned by the algorithm. Conversely, a WMC may be assigned to collect from a previously unfamiliar DCF/area, thus increasing the operational cost per tonne at least during the transition period.	Yes, the issues related to vertically integrated WMCs can be addressed separately in the current system (D.3).
F.2 Retain flexibility for self clearance and treatment and to retain the resulting revenue (if operating local authority DCFs) **(Unknown)**	**+/-:** Same as Ea.2	N/A, not an issue in the current system.
F.3 Option for self clearance and treatment of SMW from kerbside collections consolidated at WMC-operated depots **(Unknown)**	**+/-:** Same as Ea.2	N/A, not an issue in the current system.
F.4 Minimise disruption to existing logistical arrangements for WEEE (concerning e.g. asset management,	--: As previously discussed in Section 5.3.2, matching by pick-up request is likely to cause the most disruption to existing logistics arrangements. Based on practical experiences from other territories,	N/A, not an issue in the current system.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
route planning, scheduling, etc.) so as to maintain/improve efficiency **(Moderate-high)**	this method of matching can only be feasible if assets such as skips and bins are standardised in size and format (e.g. in Germany). This has been highlighted as a challenge in Spain where PCSs have the additional burden of establishing an agreement with the WMCs (or municipalities) that manage the bins on site. Furthermore, WMC stakeholders have raised that some sites may have a steady/predictable supply of WEEE that could be put on a collection rota and the route may be optimised in anticipation of other collections scheduled nearby. This would be disrupted if matching by pick-up request were introduced.	
G. Third sectors		
G.1 Improve access to reusable EEE and retain revenue **(Unknown)**	**--:** PCSs and LAs have pointed out that a long-term relationship with local organisations and communities is essential for driving re-use initiatives. This would be difficult to achieve if matching by pick-up request were established.	Yes, separate policy initiatives could be implemented to drive re-use without a matching system (A.6).
G.2 Minimise disruption to existing logistics arrangements for preparation for re-use so as to maintain/improve efficiency **(Unknown)**	**--:** Existing relationships and logistics arrangements could be disrupted for the reasons explained in F.4.	N/A, not an issue in the current system.
H. Approved Authorised Treatment Facilities		
H.1 Existing initiatives for improvement and innovation are not	**--:** If matching by pick-up request were introduced, existing relationships with PCSs could taper off. This method of matching could worsen the shortcomings raised by stakeholders, and AATFs	Yes, separate initiatives related to stability of relationships between PCSs and AATFs (A.3)

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs	Are there alternative solutions to matching for the identified shortcomings?
disrupted/disincentivised **(Low-moderate)**	could lose this stability it needs to expend resources in improvement and innovations.	could be implemented without matching in place.
H.2 Minimise disruption to existing logistical arrangements for WEEE (recycling and preparation for re-use) so as to maintain/ improve efficiency **(Low-moderate)**	**--:** Similar to F.4, if AATFs were also tasked with collection directly from DCFs, then the ad hoc nature of pick-up requests could create administrative and logistical challenges for AATFs to manage random requests with short notice. This could increase the cost of collection and daily administration, and therefore reduce the profit margin. Furthermore, if new standards were established for assets, then AATFs may be required to make investments in order to stay operationally compatible.	
H.3 Maintain currently secure supply of WEEE (if the AATF is vertically integrated) **(Low-moderate)**	**--:** Vertically integrated AATFs could lose currently secure supplies of WEEE and the resulting revenue under matching by pick-up request, as discussed in C.3.	Yes, separate initiatives could be implemented without matching in place. These initiatives could relate to the long-term stability of the system and AATFs' relationships with PCSs (A.3), future role of distributor collections (A.5), and future role of vertically integrated organisations (D.3).
I. Environmental regulators and government		
I.1 Harmonisation across nations regarding approach to WEEE management **(Moderate-high)**	**+/-:** Environmental regulators would need to harmonise their approach (e.g. scope, scale, mandatory/voluntary) to matching as well as the algorithm for matching by pick-up request. A clearing house would need to manage stakeholder transactions, data, and other responsibilities according to the rules of all four nations.	N/A, not an issue in the current system.

6.2.3 Matching by collection points

As previously discussed in Section 5.3.2, matching by collection points has a large overlap with matching by geographical split. Given the number of actors, the size of the UK and the uneven distribution of collection and treatment services (e.g. AATFs), geographical split in its simplest form is unlikely to be feasible. Therefore, it will not be evaluated in detail. Instead, potential drawbacks of a 'traditional' approach to matching by collection points could be mitigated by incorporating the strengths of geographical split (e.g. by maximising clustering of LAs in the algorithm for matching).

Note that the alternative solutions to matching identified in Section 6.2.2 remain valid with regard to matching by collection points. They are omitted from Table 11 to avoid duplication.

Table 11 Pros and cons of matching by collection points in the UK context

Stakeholder interests (level of satisfaction with the current system)	**Benefits/Drawbacks and potential trade-offs**
	--: Overall significant drawback -: Overall minor drawback +/-: Limited/unknown/uncertain overall impact to the system +: Overall minor benefit ++: Overall significant benefit
A. Common interests	
A.1 Standardise and improve service level of WEEE collection and treatment across the UK **(Low-moderate)**	**+/-:** This is a pre-requisite, rather than outcome, of matching.
A.2 Reduce administrative burden and complexity for all stakeholders **(Low-moderate)**	**+:** More LAs could have a single point of contact under matching by collection points. Even if matching occurs by WEEE stream, the number of 1-to-many relationship between DCFs and PCSs can be minimised, as seen in other territories, by a) minimising this fragmentation in the design of the algorithm and b) making the clearing house the central contact point for registering DCF requests for offtake and directing the request to the matched PCS. For PCSs and their subcontractors, this method of matching would result in a more stable and predictable cost basis than matching by pick-up request, because the locations of collection and the average tonnages arising from the matched DCFs are known for a given period. Even if market share changes led to certain

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
	changes in the matched DCFs, the scale of change is limited. This certainty would reduce the administrative burden and streamline financial planning for both PCSs and producers. AATFs' administrative burdens could also lessen with improved stability. On the other hand, there is a minor drawback that PCSs may be matched to previously unfamiliar areas and would need to expend resources to develop new working relationships with the DCFs and local providers of collection, re-use and recycling services. Based on one UK PCS's estimation, higher administrative effort could be expected in the first year of matching, and most PCSs would have the expertise to become embedded during that period.
A.3 Facilitate long-term stability in the system **(Low-moderate)**	**++:** Matching by collection points is considered by most UK stakeholders as the preferred option as it could facilitate long-term stability in the system. As noted above, the first implementation of the algorithm for matching would give PCSs a general idea of the locations and tonnages they would be responsible for under matching. While there would still be changes under matching due to fluctuations in market share, the number of DCFs involved and frequency of changes can be limited by the design of the matching system. Therefore, once implemented, PCSs would have stability in the vast majority of matched DCFs. Consequently, this could facilitate long-term relationship development between PCSs and service providers such as WMCs and AATFs.
A.4 Ensure existing and potential future regulations are enforceable **(Moderate-high)**	**+/-:** No direct impact from matching on this aspect. A prospective clearing house could take on the primary role of regulation enforcement with oversight from environmental regulators.
A.5 Increase total collection quantity, and reduce losses from the system **(Low-moderate)**	**+/-:** Compared to matching by pick-up request, this method of matching is considered to have a lower risk of deviations from set collection obligations because a stable relationship among stakeholders is thought to support improvement and innovations. However, one PCS expressed concern that, by removing competition for access to WEEE, the benefits of competition (e.g. innovation, improvement of efficiency, and minimisation of costs) would also be removed. In addition, another PCS highlighted the risk that PCSs may be demotivated from driving site-level improvements if they are only responsible for certain WEEE streams. While this can be minimised by the algorithm for matching, it would be unavoidable if matching is done by WEEE stream. Alternatively, if

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
	matching were to occur by whole sites, there would be a trade-off between PCS initiative and higher level of physical balancing or financial clearing required at the end the compliance year.
A.6 Improve the quality of collections in support of re-use and higher value retention from WEEE **(Moderate)**	**+/-:** Matching is unlikely to impact quality of collection.
A.7 Ensure the targets and other system-level incentives are aligned with circular economy **(Moderate-high)**	**+/-:** Matching by itself has neutral impact in this aspect.
A.8 Ensure national coverage of WEEE collection (via multiple channels including potentially kerbside collection) and treatment **(Moderate-high)**	**+:** Matching of any kind would ensure national coverage. Matching by collection points could be designed to account for DCFs managed by WCAs for the consolidation of SMW from kerbside collections. Potential adjustments for the UK have been suggested earlier in Table 8.
A.9 Improve the efficiency and reduce the environmental impact of the overall system **(Moderate)**	**+/-:** None of the territories researched in this study has any quantitative data to demonstrate the benefits of matching relating to logistical efficiency and environmental impact. As suggested earlier in Table 8, a UK algorithm for matching could reference good practices from other territories to create the necessary conditions (e.g. site ownership, scale, regional synergy, etc.) for efficient operation. It should be noted that, theoretically, a competitive PCS landscape would only be able to deliver local optimal efficiency, rather than national optimal efficiency, due to the nature of competition. This is the case with or without matching.
B. Producers	
B.1 Costs better reflect the true cost of compliance for producers **(Moderate)**	**+/-:** In addition to the general cost savings listed in Section 6.2.2, matching by collection points has greater potential to deliver further cost savings than matching by pick-up request, as long as the algorithm has been designed to facilitate efficient logistics. However, matching by collection points is likely to incur a higher upfront investment cost compared to matching by pick-up points, because more initial research is

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
	required to grade the DCFs according to their cost implication. Although a UK system may reference the Italian algorithm, further adjustments such as those mentioned in Table 8 could further complicate the development of a UK algorithm. PCSs, and therefore producers, are expected to fund this upfront investment.
B.2 Have the option and bargaining power to switch PCSs for the best service **(Moderate-high)**	**+:** For large producers with high obligation, matching by pick-up request would have a minor positive benefit to facilitate switching. As previously discussed in Section 6.1.1.2 , matching would provide a basic level of WEEE which helps reduce PCSs' risk exposure when providing a quote.
C. Distributors (including retailers)	
C.1 Costs better reflect the true cost of compliance (for distributors who are also producers) **(Low-moderate)**	Same as B.1.
C.2 Have the option and bargaining power to switch PCSs for the best service **(Moderate-high)**	Same as B.2.
C.3 Existing functioning collection and take back systems are not disrupted or disincentivised **(Moderate-high)**	Same as elaborated in Section 6.2.2.
C.4 Ensure that all tonnages collected from customer doorsteps and in-store count towards the distributor's own obligation (via its PCS) **(Moderate-high)**	Similar to C.4, the impact depends on the scope of the matching system and is independent of the method of matching.
D. Producer Compliance Schemes	

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
D.1 Encourage healthy and fair competition amongst PCSs for producer members **(Low-moderate)**	**+:** In line with B.2, matching by collection points could help PCSs in competing for producer members based on sound quotes and avoid taking on excessive financial risks.
D.2 Future-proof the system: potential changes to the system need to be compatible with kerbside collection (in case it is mandated) and support relationship-building with WCAs **(Moderate)**	**+/-:** Matching by collection points could adapt to incorporate kerbside collection. It is highly advisable to consider the sequence of implementing kerbside collection and matching and the cost implication. As discussed previously, if kerbside collection were to be introduced after matching, then it could lead to significant reworking of the algorithm for matching. If matching were to be introduced after kerbside collection has become well-established, then the research and development of the algorithm for matching can be expanded to include WCA-managed DCFs/consolidation points. This means additional upfront investment, though the scale depends on the number of WCA-managed collection points that would be relevant for matching, and so cannot be estimated at this moment.
D.3 Retain flexibility to choose suppliers and partners and retain the resulting revenue (if the PCS is vertically integrated) **(Low-moderate)**	**-:** Matching by collection points would limit, but not necessarily eliminate, the flexibility for PCSs to choose which LAs (and potentially retailers if included in scope) they would like to work with. For example, the algorithm could seek to preserve long-running relationships as much as possible. Matching by collection points could still constrain PCSs' choice of partners due to the uneven distribution of collection and treatment service providers.
D.4 Encourage fair competition of PCSs: require and allow more PCSs to undertake physical collections according to their members' obligation requirements **(Low-moderate)**	**++:** As elaborated in Section 6.2.2, this is the main purpose and benefit of matching in general.
D.5 Encourage fair competition of PCS: require all PCSs to undertake collection from both low- and high-cost areas **(Moderate-high)**	**++:** This is a distinct benefit of matching by collection points compared to other methods. Potential adjustments to address this problem in the UK have been suggested earlier in Table 7.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
E(a). Waste Disposal Authorities	
Ea.1 Retain flexibility in defining the terms of contract and level of assurance from the chosen partners **(Moderate)**	**+/-:** Compared to matching by pick-up request, there would likely be more minor drawbacks during the transition period. The long-term impact is considered to be neutral assuming supporting policy initiatives are put in place. UK stakeholders have recognised that new relationships will need to be built, especially for PCSs that are currently inexperienced in LA collection. Therefore, from a LA's perspective, there could be short-term uncertainty and inconsistencies in service level. This can be mitigated during the preparatory phase, by establishing a national common service level agreement well in advance and requiring all PCSs participating in matching to demonstrate their operational plan for collections (as seen in France).
Ea.2 Retain flexibility for self clearance and treatment and to retain the resulting revenue (if operates DCF in-house) **(Unknown)**	**+/-:** A matching system could allow DCF operators to opt out for self treatment, as seen in practice in other territories.
Ea.3 Retain on-going investments for operational and infrastructural improvements **(Moderate)**	**-:** As discussed in Section 6.2.2, only bespoke arrangements that align with the full net cost principle would be standardised in the common service level agreement.
E(b). Waste Collection Authorities	
Eb.1 Have flexibility in defining the terms of contract and level of assurance from the chosen partners **(Unknown)**	**-:** Same as Ea.1 except WCA's service procurement would focus on waste haulage rather than uplift.
Eb.2 Have flexibility for self clearance and treatment and to retain the resulting revenue **(Unknown)**	**+/-:** Same as Ea.2.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
Eb.3 Receive on-going investments for operational and infrastructural improvements for kerbside collection (if mandated) **(Unknown)**	**+/-:** Funding provided to WCAs for kerbside collection could occur with or without matching.
F. Waste management contractors	
F.1 Retain flexibility to choose partners and retain the resulting revenue (if the WMC is vertically integrated) **(Moderate)**	**--:** Same as elaborated in Section 6.2.2 for matching by pick-up request.
F.2 Retain flexibility for self clearance and treatment and to retain the resulting revenue (if operating local authority DCFs) **(Unknown)**	**+/-:** Same as Ea.2.
F.3 Option for self clearance and treatment of SMW from kerbside collections consolidated at WMC-operated depots **(Unknown)**	**+/-:** Same as Ea.2.
F.4 Minimise disruption to existing logistical arrangements for WEEE (concerning e.g. asset management, route planning, scheduling, etc.) so as to maintain/improve efficiency **(Moderate-high)**	**+/-**: Matching by collection points would cause less disruption to existing logistics compared to matching by pick-up request. There may be challenges during the transition period if new relationships need to be developed. Based on UK stakeholder feedback, this is considered a minor and a temporary setback.
G. Third sectors	
G.1 Improve access to reusable EEE and retain revenue **(Unknown)**	**+:** As discussed in Section 6.2.2, long-term relationships with local organisations and the community are deemed essential for driving re-use initiatives. This would be a benefit of matching by collection points, if the algorithm is designed to preserve on-going relationships and minimise fragmentation of DCFs.

Stakeholder interests (level of satisfaction with the current system)	Benefits/Drawbacks and potential trade-offs
G.2 Minimise disruption to existing logistics arrangements for preparation for re-use so as to maintain/improve efficiency **(Unknown)**	**+/-:** Existing relationships and logistics arrangements could experience disruption during the transition period (F.4). However, the benefits of a long-term working relationship with a PCS would likely outweigh the temporary drawbacks
H. Approved Authorised Treatment Facilities	
H.1 Existing initiatives for improvement and innovation are not disrupted/disincentivised **(Low-moderate)**	**+/-:** If matching by collection points were introduced, there is a minor risk that new PCSs could be matched to the area served by an AATF. A new PCS could be one that does not currently have a strong presence in the region, or that is new to LA collection as required by matching. As a result, some of the existing relationships with PCSs could be disrupted. This is a temporary set-back, and it is expected that new long-term relationships could be established between PCSs and AATFs as the matching system matures.
H.2 Minimise disruption to existing logistical arrangements for WEEE (recycling and preparation for re-use) so as to maintain/improve efficiency **(Low-moderate)**	**++:** Similar to F.4, AATFs could face minor temporary risks during the transition period and if physical balancing were implemented. However, these risks are likely to be outweighed by the benefits brought by stability in the system. Matching by collection points would allow AATFs to have a more complete knowledge of PCSs that are likely to become established in the area and establish a longer-term service agreement so that AATFs would have higher certainty of the proportion of the local WEEE arising that they would need to collect and treat. Knowing the source and scale of supply would enable AATFs to plan, improve and invest in their logistics.
H.3 Maintain currently secure supply of WEEE (if the AATF is vertically integrated) **(Low-moderate)**	**-:** Vertically integrated AATFs could lose currently secure supply of WEEE and the resulting revenue under matching by collection points, as discussed in C.3 of Section 5.2.2.
I. Environmental regulators and government	
I.1 Harmonisation across nations regarding approach to WEEE management **(Moderate-high)**	**+/-:** Environmental regulators would need to harmonise their approach (e.g. scope, scale, mandatory/voluntary) to matching as well as the algorithm for matching by collection points. A clearing house would need to manage stakeholder transactions, data and other responsibilities according to the rules of all four nations.

6.2.4 Financial clearing without matching of physical collections

The role of financial clearing is limited to balancing deviations in collections and therefore will not be compared against the identified shortcomings of the system. Stakeholders including LAs, PCSs, WMCs and AATFs generally prefer financial clearing over physical balancing or rolling-over of credits and debits.

The UK already has a form of financial clearing through evidence notes and the compliance fee mechanism. In other territories reviewed in this study, financial clearing or balancing typically takes place by establishing an average cost per tonne for clearing among PCSs, based on a commonly agreed scope of costs including the actual operating costs and other relevant costs such as overheads. The level of resources needed to calculate the cost per tonne can vary from onerous one-to-one negotiations (e.g. in Slovenia) to an IT platform (e.g. Ireland). This approach is similar to the principle of the 2020-21 compliance fee methodology, though without the escalator applied.[28] If the compliance fee were to be removed in the future, the approach of financial clearing by average cost per tonne would be the most familiar and likely workable solution for PCSs. An independent third party could be tasked with administrating the online system for data submission and financial transactions, same as the existing arrangement for compliance fee.

An alternative approach is seen in Sweden, where two PCSs have established a common and public price list for financial clearing. The price list is then subject to revision periodically. Although this approach works for Sweden with a limited number of PCSs, this is unlikely to be feasible in the UK with a much more competitive landscape.

[28] Joint Trade Associations, 'Operation of a WEEE Compliance Fee for the 2020 Compliance Period', September 2020, https://consult.defra.gov.uk/product-regulation-and-producer-responsibility/consultation-on-weee-compliance-fee-methodology-20/supporting_documents/JTA%202020%20Proposal%20Final.pdf.

6.3 Potential barriers to implementation and mitigating strategies

Previous evidence has suggested that **matching by collection points** is the option deemed most feasible by the vast majority of the stakeholders who have engaged with this study. This section will focus on barriers to implementation that have emerged from interviews and surveys for this method of matching, many of them already highlighted in Section 6.2.3 as potential drawbacks. Potential ways of overcoming these barriers are discussed drawing from learnings from other territories detailed in Section 5.3.2. Note that the likely contribution from potential future changes to the system are also considered.

Table 12 Barriers to implementing matching by collection points in the UK, and potential mitigations

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
Cross-sectoral barriers	
Stakeholder concern of reduced/stagnating collection rate due to less incentive to innovate and improve LA collection and re-use	As discussed in the previous section, UK stakeholders have conflicting views about the purpose, benefits and drawbacks of matching. Within the same stakeholder group, views can also diverge - as observed from discussions with various PCSs. This lack of consensus is a significant barrier to implementation. When compared against the baseline 'do nothing' scenario, a more divisive option may not be favoured in policy impact assessments. Indeed, the 2013 Impact Assessment listed the target and compliance fee mechanism as the preferred policy option primarily because of the stakeholder division on matching.[29] Unlike in 2013, no stakeholder considers the current system to be critically failing (as highlighted in Section 6.2.1); rather, they focus on incremental improvements needed for the current system. Therefore, fewer stakeholders may rally behind matching since it would significantly affect the way PCSs, LAs and distributors operate, but the benefits of matching are more structural adjustments and relate indirectly to performance metrics such as collection rate. To reassure affected stakeholders, the timing and design of the matching system needs to be planned out. It is advisable that: • A phased approach is taken for implementing systemic changes affecting physical flows of WEEE, such as kerbside collection. This is to ensure that reliable operational information (e.g. quantities, product types, consolidation points) can be fed into the planning stage for matching. • Stakeholder concerns about collection rate and efficiency are explicitly mitigated either by the design of the algorithm for matching (e.g. include criterion to preserve existing relationships and give even higher priority to preserve long-running ones, minimise contact points and maximise PCSs'
Stakeholder concern of less incentive to improve collection efficiency	
Stakeholder concern of losing rapport/local knowledge and efficiencies developed from existing/long-running relationships between certain PCSs and WDAs (Waste Disposal Authorities).	

[29] Daniel Coleman and Graeme Vickery, 'WEEE System Impact Assessment (BIS 0393)'.

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
	accountability for a whole site, etc.) and/or by supplementary policy initiatives. • A transitional period roadmap (based on a conservative estimate of 3-4 years) should be developed at the outset so that all stakeholders involved have enough time to establish the clearing house and the algorithm for matching, establish new contacts and relations, conduct due diligence where required, manage the process of change for staff and internal systems, and resolve potential operational issues with new partners.
Potential complexity of developing a UK algorithm that is fair and future-proof	If matching does attract sufficient stakeholder support, then the next barrier is the potential complexity of the algorithm. The main sources of complexity are: • The wide range of geographical and socio-economic conditions that influence WEEE disposal and collection; • The uneven distribution of collection and treatment services in the UK; and • The existence of PCS-DCF relationships that need to be preserved as much as possible. To ensure LAs are matched to PCSs fairly, background research is required for grading geographic areas/LAs based on existing quantities of WEEE arising per stream and location. The PBS may be a useful source of cost data when identifying and matching higher cost geographical areas. Development of the algorithm may require additional stakeholder engagement and cost-benefit analysis to determine whether the algorithm should include grading of specific DCFs (e.g. site type, capacity, accepted WEEE streams, geography, proximity to treatment facilities) in combination with overall LA scoring. The algorithm needs to be scalable to accommodate a large number of PCSs and DCF operators. Clear rules should be set out in anticipation of changes in the system, such as matching of new DCFs and succession plans if a PCS discontinues operation. Under specific or unforeseen circumstances, the clearing house could also facilitate discussions among stakeholders (e.g. LAs, distributors and PCSs) to reach mutually-agreed practical arrangements that are a preferred alternative to the algorithm results. One instance of such alternative arrangements could be to swap matched DCFs between PCSs to preserve existing efficient 'milk round' collection routes for cost and environmental benefits. Lastly, it is highly advisable that any alternatives to the current weight-based targets for individual PCSs are consulted upon before planning for a matching system. This would mitigate the risk of misalignment between the system incentive and the

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
	matching methodology as well as any supplementary policies, which would require additional efforts and resources to rectify.
Potential complexity of establishing a UK clearing house with harmonised rules for all four nations	A matching system is typically administrated by either a public authority or a clearing house. Public authorities such as the environmental regulators may prefer to only have oversight of the matching system rather than managing the day-to-day operations. Therefore, converging on a remit and governance structure for the clearing house is another significant barrier to implementation which affects all stakeholders. In other territories where a clearing house is set up, the initial investment and annual operating budget are typically paid for by producers via their PCSs, according to market share. Irrespective of this, the remit of a UK clearing house and its associated costs would potentially require significant discussion and negotiation. This process may be simplified if the remit of the clearing house focuses on core tasks, and it only assumed additional responsibilities if clear synergies are identified. Determining the governance structure presents another barrier due to the number of industry stakeholders and the need to represent all four devolved nations. With reference to examples identified in this study, the governance structure may consist of multiple supervisory and management groups (e.g. oversight from regulatory bodies, board for overall management and budget approval, advisory board, executive committee, etc.), and their seats would be periodically re-assigned. Lastly, the challenge of harmonising the rules of a matching system across all nations is not to be underestimated. If there were more than 1 matching system in the UK, the overall system could be over-complicated by different algorithms and rules for matching and balancing/clearing, not to mention a duplication of overheads in multiple clearing houses. Furthermore, each nation's preferred approach to WEEE could also differ based on its waste and resource strategy. To overcome this challenge, engagement and consultation with environmental regulators and policy makers in all four nations is an essential first step in the planning phase. The regulators and policy makers may establish a list of principles by which a UK matching system and clearing house must abide.
Barriers for producers/distributors	
Uncertainty in the impact on retailer collection and logistics	For distributors that are not EEE producers but are required to collect WEEE on their premises, the impact relates only to on-site collection, storage, handling, liaising with PCSs, and other WEEE-related administrative tasks. It is important for the design of a matching system to recognise the wide variety of distributor reverse-logistics set up. For example, disruption could be

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
	minimised by matching hubs to PCSs for distributors with centralised operation; whereas for distributors with de-centralised operations, matching most (if not all) store locations to one PCS would lower the administrative burden. For distributors that are also producers who collect WEEE under their own initiatives for both business and compliance purposes, the impact on their operation is complicated by the risk that their collections could be matched to other PCSs instead of being used to discharge their own obligations. A potential mitigation is that WEEE collected by these distributors could be first used to discharge their own obligations, and only the excess would need to be entered into a UK matching system. However, a potential unintended consequence of this mitigation is that some distributors may be deterred from increasing collection under their own initiatives beyond in-store collections. Distributors' motives to collect WEEE are three-fold: compliance and waste duty of care (from being a EEE producer and/or outside the DTS), financial, and non-financial such as brand reputation. For distributors and retailers that are also EEE producers, they could become hesitant in expanding their collection services beyond in-store collection (e.g. offering 1:0 collection for a charge by request) if the risks associated with more complicated compliance activities due to greater participation in matching are perceived as outweighing the benefits. Beyond the matching system, the role of distributors should also be considered as part of the wider system reform, aiming at increasing collection whilst avoiding demotivating distributors, for example by evaluating potential reforms for covering the legitimate costs incurred by distributors under the full net cost principle. Alternatively, a matching system could exclude distributor-controlled collection routes. Instead, distributors may continue to hold bilateral contracts with their PCSs. In the case of distributors belonging to separate PCS arrangements (e.g. RTB WEEE Compliance), the distributor-only PCS would not be matched to any LA DCFs and may continue its current in-house operations. The matching system could instead serve as a fall-back option for any orphaned retailer DCFs or in-store take back locations. The risk of taking this approach is that, if high weight-based collection targets remain a part of the overall WEEE system, this could lead to a price being established for WEEE collected by distributors, thus undermining the principle of a level playing field. At worst, this could lead to distributors actively seeking to divert WEEE from LA sites (matched) to their own collection channels (unmatched), to unduly benefit from the amounts collected. When approached with this scenario, UK stakeholders hold different views, with some challenging that this risk would not

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
	materialise based on past interactions with distributors. Nevertheless, this is a crucial consideration for a UK matching system.
Uncertainty in the cost implication for differing PCSs and their producer members	This risk varies by PCSs and therefore their producer members, as it depends on each PCS's existing LA DCF network. Producers may become more supportive of matching if common cost savings are made clear to them, e.g. less duplicated overheads and lower overheads and fewer resources expended on tender activities.
Barriers for PCSs	
Potential trade-off between flexibility (matching by WEEE stream) and efficiency (matching by whole site)	Stakeholder engagement has shown there are conflicting views about how matching by collection points could be best implemented. Recognising that one of the aims of matching is to share out access to WEEE according to PCSs' market shares, it is advisable that matching is done by WEEE stream, as is commonly seen in other territories. However, there is a risk that PCSs could be prevented from improving collection efficiency or identifying re-use initiatives if streams are not grouped when matched to a PCS. This risk could be mitigated by a combination of algorithm design (i.e. minimise the number of PCSs matched per DCF) and separate interventions (e.g. complaint mechanism for DCF operators, visible benchmarking of PCSs' performance KPIs at DCFs/WDAs with similar operating conditions).
Risk of losing economies of scale (by WEEE stream or by regional synergy)	This risk could be mitigated in the design of the algorithm, for instance by including a criterion to minimise the total distance between all DCFs matched to a PCS, in effect attempting to match a cluster of DCFs.
Complexity as to the future role of vertically integrated PCSs	This barrier is associated with a point of contention within the UK system. A wider policy decision would need to be made. Technically, matching can work either way.
Barriers for local authorities (WDAs and WCAs)	
Potential complexity in establishing a national service level agreement for PCSs and their contractors, including contingencies	This is a barrier because the UK service level agreement would need to satisfy a variety of LA conditions, needs and preferences. A potential approach is to establish a working group of LA representatives and PCSs to compare the terms of contract in recent tenders and to communicate expectations/concerns. The group may then work towards a consensus on setting an agreed service level with contingencies (potentially adapted to the grading of WDA/DCF) and value-added services that are justifiable by the full net cost principle and not already covered by a potential central investment fund (e.g. social value based on grading of WDA).

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
Risk of losing value-added services and funding from competitive tenders	As discussed above, this risk can be mitigated by developing consensus and standardising the justifiable value-added services in the national service level agreement, which should ensure all DCFs obtain justifiable value added services, not just those with access to low cost WEEE.
Potential limitation of DCF capacity if a minimum clearance amount is required	Whilst a matching system should consider the environmental impact of collecting very small amounts of WEEE, there is currently a knowledge gap in understanding the complexity in DCF operation and the typical tonnage per collection. Tonnage per collection is not necessarily linked to DCF sizes. For example, there are known challenges associated with quantifying quantities collected from multiple DCFs on a 'milk round'. Additionally, other arrangements such as scheduled and call-off collections are also common, depending on how WEEE fits into the LAs' overall waste remit. Further research into this area is needed to inform a reasonable threshold for WEEE off-take under matching, without creating unintended consequences for other waste streams.
Risk of change management and administrative burden	The risk of change management has been discussed under cross-sectoral barriers and pertains to planning for the transitional period. The risk of administrative burden can be mitigated by firstly minimising the number of PCSs matched per DCF by the algorithm, and also by appointing the clearing house as the central contact point for administrative tasks.
Barriers for waste management contractors	
Risk of less, secured WEEE evidence notes	In addition to the cross-sectoral and PCS-specific barriers discussed above, WMCs that also operate their own PCSs may face an additional challenge of losing revenue associated with WEEE treatment at WMC-operated AATFs. The vertically integrated WMCs also face the risk of needing to seek out additional sources of WEEE outside of the matching system to meet their targets, if the target and compliance fee mechanism were maintained. The mitigation strategy for this risk is the same as other concerns related to severed working relationships; the algorithm for matching can include a criterion to maximise preservation of existing relationships including those occurring within the same organisation. Note that this approach can only reduce - and not eliminate - the risk, as the algorithm for matching must prioritise fair distribution.
Barriers for third sectors	
No responses from third sectors were received. Assume that a main barrier is the risk of reduced	Potential disruptions to third sectors should be foreseen during the transition period, as new relationships would need to be established. Managing new partnerships with the third sector is

Barriers to implementation from stakeholders' perspectives	Explanation and potential mitigating strategies
supply and collaboration with PCSs.	also relevant for PCSs, if future targets evolve to include re-use metrics. Under matching, PCSs could be required to support relationships between LAs and re-use organisations as part of the PCS/DCF service agreements, which would help to ensure proper re-use. If re-use quantities fall significantly below historical averages, then separate initiatives could be implemented.
Barriers for Approved Authorised Treatment Facilities	
Risk of increased administrative burden of managing accounts and evidence notes	Similar to LAs, the risk of administrative burden can be mitigated by centralising the flow of information through the clearing house. This would require a secure IT platform for handling sensitive data and securing the chain of evidence. Alternatively, the UK matching system could continue to let PCSs manage their relationships and data flows with AATFs, and the clearing house would separately obtain data from the PCSs.
Risk of reduced logistical efficiency depending on level of market fragmentation post matching	Some DCFs may still be matched to multiple PCSs in order to ensure fair distribution of WEEE by market share. However, the likelihood of this risk can be reduced when designing the algorithm. Furthermore, a potential PCS service level agreement may include a clause pertaining to the efficiency and environmental impact of collection; for example, if multiple PCSs serve the same DCF, the service level agreement may require the PCSs to coordinate off-take and minimise the 'WEEE mileage' leading up to an AATF.
Barriers for environmental regulators and devolved administrations	
Risk of potential complexity in managing the transfer of authority and responsibilities to clearing house	This is judged to be a relatively minor risk that can be mitigated by clearly defining the remit and governance structure of a clearing house, and by having a 3-4 year transitional period. It should be noted that internal processes may differ for each environmental regulator and administration. Therefore, representatives from each regulator/administration should engage in the development of a clearing house to ensure that its roles and responsibilities satisfy the needs and context of each nation.

6.4 Costs and benefits to UK stakeholders: an assessment of the preferred option

This section examines the perceived impacts to each relevant stakeholder in the WEEE system, drawing from the feasibility analysis above. Note that impacts relating to other potential reforms, such as changes to targets or mandated kerbside collection, are out of the scope of this analysis.

Where possible, quantitative estimates of the costs and benefits are given based on data gathered from stakeholders. A significant challenge faced by this study is the lack of quantitative data to support a comprehensive cost and benefit analysis. Since most matching systems have been in place since the beginning of the WEEE system, there is a lack of quantitative evidence on the operational benefits of matching. Furthermore, the project team were not able to source cost/revenue data due to commercial sensitivity. Instead, a qualitative assessment is given by the following criteria:

- Minor impact: The impact is temporary (i.e. only relates to the transitional period) or infrequent (i.e. less frequent than annual occurrence) and relates to supporting activities (e.g. administration, financial transactions).
- Moderate impact: Temporary or persistent, the impact relates to an incremental change in core activities (e.g. tender and contract management, coordination of WEEE collection and treatment, evidence and data management) from the baseline scenario.
- Significant impact: Temporary or persistent, the impact relates to a step change in core activities.

6.4.1 Impact on PCSs and producers

Costs to PCSs and producers

For a producer that is currently a member of a PCS with limited to no collection from LA DCFs, introduction of matching leads to three transition scenarios, all involving a cost increase.

- **Costs for producers to seek out a new PCS (minor):** The first transition scenario is that a producer may change PCSs. This could be a forced decision (e.g. if the incumbent PCS fails to re-qualify under new service standards required by matching and discontinues its operation entirely) or an active one (e.g. the producer decides to change PCS for a better value proposition). In any case, the potential cost of switching already exists within the current system as most producers periodically assess their PCS against market alternatives. Large producers would face greater impact if this risk materialises, for example if a producer prefers to stay with the same PCS due to cost and complexity of switching, but is forced to switch as its current PCS could not deliver on new requirements under matching.
- **Cost for PCSs to establish new collection and treatment network to re-qualify (moderate to significant):** The second scenario is that the incumbent PCS meets the requirements by establishing its own logistics network or by contracting another PCS to collect on its behalf. In the former case, the PCS should foresee significant costs associated with establishing relationships with DCFs, conducting due diligence, and establishing service agreements with collection and treatment service providers during the transitional period. In the latter case, the cost is likely more moderate in comparison and at lower operational and financial risks to a PCS new to DCF collection.
- **Cost for process change management if PCSs choose to merge operations to re-qualify (minor to moderate):** In the last scenario, the incumbent PCS fails to re-qualify and instead decides to merge operations with another qualified PCS (e.g. via an acquisition). The cost of change for the transition is classified as minor given its temporary nature. Example one-off costs include updating the contract management, data management and financial systems. After the transition is complete there could be a moderate recurring cost associated with more DCF collection activities.

In addition to the transition costs above, PCSs that currently dominate low-cost DCFs or do not collect from DCFs at all may face an increase in costs (moderate to significant). The level of cost increase depends on the PCS's current capability, coverage of collection, and arrangements with the DCFs. If a PCS currently dominates low-cost DCFs, such as those with large capacities or located close to AATFs, then these cost advantages would be evened out under matching. Another consideration is that the cost increase would be less significant if the low-cost DCFs currently have bespoke arrangements for value-added services given their perceived cost advantage. Even if an algorithm for matching is designed to preserve existing long-running relationships, the PCS would still lose some of the low-cost DCFs and instead be matched with high-cost DCFs. Conversely, producers and their PCSs that dominate high-cost DCFs would expect moderate-to-significant benefits from being matched to low-cost DCFs in exchange.

Levelling the cost basis means that some PCSs may face competitive challenges at least in the early stages of taking on collection. Their competitiveness could recover as they gain operational know-how and so improve on efficiencies. However, PCSs with small market shares may be less resilient.

Further to the levelling of cost basis, all producers and PCSs would incur transition costs for establishing new working relationships and logistics arrangements under matching. While there is a lack of data on costs, this is judged to be a minor-to-moderate cost. The transition cost would be minor if the matching algorithm preserved most of the existing relationships. However, if the matching algorithm also included distributor DCFs, then the transition cost could create a permanent increase in PCS overheads to cater for a wider group of distributors compared to the current arrangements.

Lastly, the following costs are applicable to all producers and qualified PCSs:

- **Cost for initial planning, research and development of a matching system and algorithm (significant):** The costs would be in the form of both direct financial contribution and staff hours for on-going engagement with the subject. It is difficult to forecast how much time or cost would be expended, however extensive preparatory work is anticipated to develop a fair, robust, and progressive matching system in the UK. For reference, it took Italy two years to complete the policy consultation whilst preparing for a clearing house at the same time. It would likely take the UK a similar amount of time to complete this process.
- **Cost for the set-up and operation of a clearing house (moderate to significant):** The set-up and operating cost depends on the scale and agreed remit of the UK clearing house, the number of participating PCSs and collection points.[30,31] Out of all territories reviewed in this study, Italy's clearing house offers the most comparable cost estimates. It is estimated that just under €2 million were spent on initial set-up and IT development. Costs to the UK could be lower if the clearing house focuses only on managing the matching system and is not involved in coordinating day-to-day interactions amongst stakeholders. Correspondingly, the annual operating cost of a UK clearing house could be lower than that of Italy which is around €1 million per year. In Italy's case, the largest cost is staff, followed by subcontracted services such as IT and a call centre.
- **Potential financial contribution into a central fund targeting at reducing losses (moderate to significant):** As discussed in Section 6.3, one of the potential barriers to matching is that bespoke arrangements for DCFs would be replaced by a standard service agreement. The possibility of a central fund as discussed before could be one way to ensure that DCFs are sufficiently supported and incentivised to improve WEEE management. Such a fund would likely be paid by PCSs according to their market share, and ultimately paid by the producers. The scale of this fund is currently

[30] In Italy, there are 12 PCSs with B2C WEEE obligations that are members of the clearing house. 4,250 municipal collection points and 820 private collection ones are matched. In the UK, there are 28 PCSs including 1 that is B2B-only (B2BWEEE-SCHEME) and 10 that currently collect from LA DCFs. There are in total 1,130 municipal DCFs and an estimated 500 retailer collection points in the UK as of 2019, though the latter is expected to have expanded under the DTS. See reference 29.

[31] Alex Forrest and Mark Hilton, 'DTS 01/19: Assessment of WEEE Collection Systems and Their Effectiveness in Other European Countries', December 2019.

unknown; therefore it could range from moderate to significant. For PCSs that already have bespoke arrangements for the majority of their LA contracts, the impact would be moderate as these costs are already incurred. For PCSs that have little to none of such arrangements, the cost contribution would be more significant.

Benefits to PCSs and producers

The following sources of benefits are applicable to all qualified PCSs and their members, independent of the design of the algorithm for matching.

Cost saving for those PCSs that currently collect from LAs, from no longer needing to prepare tender responses or attempting to match (new) members' obligations with the PCS's contracted collection obligation (moderate): A stakeholder estimates the cost saving to be equivalent to the wage of a full-time staff member for business development with LAs and distributors. This cost is currently duplicated across PCSs each time a tender is released.

Cost saving from no longer needing to offer revenue-sharing agreements or bespoke arrangements that are not justified under the full net cost principle (moderate): Matching also removes the need for PCSs to offer revenue-sharing agreements or bespoke arrangements subject to inconsistent requirements in public tenders to access WEEE. The level of this impact is judged to be moderate, as Table 8 has shown that value-added service can account for up to 25% of the contract evaluation criteria, implying sizeable financial resources expended by the PCSs in both preparation and execution of these offerings.

PCSs would retain all material sales revenue from collected WEEE under the full net cost principle (moderate, overlaps with the point above): This is a benefit that is then transferred to producer members. Due to commercial sensitivity, the potential scale of additional revenue cannot be quantified. This benefit is judged to be a moderate impact as it represents an incremental change in core activities.

Reduced exposure to financial risk due to lower reliance on buy-out options such as evidence note purchases and compliance fees (moderate): Matching WEEE streams by collection points provides PCSs a baseline amount of WEEE according to their market share. This would allow PCSs to take on a large producer with less uncertainty over the source for additional WEEE. This would also mean less need for purchasing evidence notes or paying a compliance fee, where prices are out of the control of the paying PCS thus creating a higher financial risk. Under matching, this risk would still exist as there would be a need for post-matching balancing; however, the magnitude of this risk would decrease. The saving cannot be quantified since it depends on the accuracy of the algorithm for matching and whether the target and compliance fee mechanism is maintained. Nevertheless, this is judged to be a moderate benefit as it represents an incremental change in core activities.

Linked to the point above, matching links a PCS's access to DCFs and therefore would allow producers (particularly large ones) to move more easily between PCSs, thereby encouraging competition between PCSs. The benefit of improved competition among PCSs for producers can be financial (e.g. lower fees) and non-financial (e.g. provision of advisory services). The magnitude of this benefit is not categorised as it would be highly case-dependent.

At the system-level, the following benefits are applicable to all producers:

- Reduced duplication of overheads and staff cost, potentially also including subsistence fee payments from fewer qualified PCSs (moderate to significant): As matching would mandate PCSs to participate in collection beyond only financing it, PCSs would need to demonstrate their capability to meet a

national service level agreement. This effectively raises the entry requirements for PCSs. As a result, matching would likely reduce the number of PCSs and duplicated costs. The level of change in subsistence fee payments would depend on whether costs incurred to environmental regulators are independent from the number of PCSs in the market.

- **Elimination of PBS-associated costs (minor to moderate)**: At a minimum, the annual administration and external audit costs (£7,500 in total) would be saved. As the PBS operates on a bidding system and can often be only for certain WEEE streams, the cost is not optimised. Therefore, replacing the PBS with matching would likely reduce cost for producers and PCSs because collections could be organised more efficiently, particularly if as many WEEE streams as possible are allocated to one PCS for each DCF. It should be noted that certain PCSs could still experience an increase in collection cost despite efficiency gains, particularly if they are matched to LAs previously managed under the PBS.
- **Potential cost savings from centralised administrative tasks coordinated by the clearing house (moderate)**: Matching requires coordination by a clearing house, which could introduce further efficiency and therefore cost savings, by centralising certain activities that are currently repeated by PCSs. As discussed in Section 6.1.1.2, activities such as establishing service level agreements and centralising data reporting could be managed by the clearing house, and each PCS would pay its market share of these costs rather than the full cost of keeping these tasks in-house. This impact is considered a moderate benefit as it is an incremental change to PCSs' core activities, though it should be reiterated that the level of cost saving would depend on the remit of the clearing house.

Depending on the design of the matching algorithm, additional moderate efficiency and cost saving could be achieved. For example, if the matching algorithm enables clustering of DCFs that form more efficient collection routes, then producers, PCSs and their subcontractors would all benefit from lower transport cost and environmental impact. Another example is that if the matching algorithm fostered stability in the system, then PCSs could accumulate knowledge of the DCFs they operate in, and identify opportunities for improvement and cost saving. In addition, if the matching algorithm minimises the number of PCSs matched to each site, then a PCS and its subcontractors could achieve moderate benefits from improving economies of scale across WEEE streams and reduce the number of separate collections.

6.4.2 Impact on distributors

All the costs and benefits discussed above apply to distributors who are also producers. This section discusses the additional impact to distributors, depending on whether and how WEEE arising from their collection channels (e.g. take back, warranty return, retailer DCFs or in-store collection) are included in matching.

Distributor-specific costs (if collection points are included in matching)

- **Lost financial benefit from losing a proportion of its own managed collections to other PCSs (moderate to significant)**: Consider WEEE collected from distributors' own take back and warranty return from customers: it has been previously highlighted in Section 6.1.1.2 that the reverse logistics for this WEEE is well-established, and these channels are significant sources of WEEE especially for categories such as LDA.[32] LDA collections are also revenue streams as they have medium-to-high levels of profit.[33] If matching required distributors to hand over these WEEE to any matched PCS regardless of whether the distributor is a member of the matched PCS, then the incumbent PCS for the distributor could lose out on a significant source of WEEE and revenue.

[32] Environment Agency data for UK household WEEE collection in 2020 shows that household WEEE returns under regulation 43 (returned by distributors to PCSs) contributed 31% of the total collected tonnages; with the top 3 contribution in EEE categories: Large Household Appliances (50%), Cooling Appliances Containing Refrigerants (37%), and Photovoltaic Panels (10%). Data sources: https://www.gov.uk/government/statistical-data-sets/waste-electrical-and-electronic-equipment-weee-in-the-uk

[33] Mark Sayers, 'Evaluating Opportunities to Establish an Investment Fund for WEEE Infrastructure'.

- If the distributor is also a producer, then there could be higher exposure to financial risks due to potentially greater reliance on buy-out options (moderate to significant): The scenario is that a distributor may be able to fully self-comply due to its own collection today, but could fail to do so if its collections were matched to multiple PCS and total matches to its own PCS (including WEEE from other distributors and LA DCFs) are insufficient to discharge the distributor's individual obligation. This would lead to greater reliance on evidence purchase or even compliance fee. The significance of this cost implication would depend on the overall system. This cost could be mitigated by allowing any producers who collect WEEE under their own initiative to match their collections first to their own requirements, with any excess to their own direct requirements being moved to the national matching system. However, a potential unintended consequence of this approach is that it could complicate the compliance activities for certain distributors, thus potentially deterring them from expanding their collection services beyond in-store collection as a way of limiting their involvement in the matching system.
- Higher overhead and training costs resulting from the need to deal with multiple PCSs, multiple contractors, elimination of standardisation of collection arrangements, and the need to aggregate data from multiple operators for corporate social responsibility (CSR) reporting (moderate to significant): Distributors with centralised reverse logistic hubs may face fewer challenges on this front, as matching could be applied to these hubs rather than to individual store collection points. However, the impact would be more significant for distributors that lack such centralised systems and currently request PCSs to collect from stores. Note that a distributor matched to only one PCS could still retain the benefits of a nationally standardised service (e.g. standardised containers and collection methods, simpler data aggregation for CSR reporting); however, it remains a question whether and how the variety of UK distributors could be exclusively matched to PCSs whilst ensuring fair allocation.

Distributor-specific benefits

If a weight-based target and compliance fee mechanism is retained and private collection points are not matched, there is potential for distributors to receive more support from PCSs for expanding collection network and driving more and higher quality collections (moderate): This benefit is expected to be a moderate one as a functioning matching system should mitigate against any distorting effects from distributors seeking to unreasonably benefit from the WEEE they hold. Reforms to the overall WEEE system could also serve to mitigate the risk of undue economic rents (i.e. producers funding more than the necessary costs against the full net cost principle) under matching; for example, requiring evidence to only be generated for WEEE managed under the matching system.

Avoided payments under PBS for categories where a distributor has already achieved compliance (moderate to significant): This is specific to distributors who are also producers. As one major UK retailer has raised during interview, under the current PBS system there have been cases where a retailer would need to share the cost of certain WEEE fractions for which the retailer has already achieved compliance via its own collections. These costs would be saved under matching since the PBS would no longer be needed. The level of cost saving would depend on the EEE POM and in-house collection profile of the distributor.

6.4.3 Impact on local authorities

Costs to LAs

For LAs that operate their own DCFs, a key cost is the loss of financial contribution (e.g. revenue-sharing agreements) and bespoke services (e.g. delivering social value) from existing contracts (moderate): While this cannot be quantified exactly, this cost is judged to be moderate. This is because although LAs hold strong bargaining power in dictating the terms of the contract including financial

contribution, WEEE is not a high-priority waste stream for them due to its comparatively lower quantities. Therefore, the total value that LAs can retain from WEEE is limited.

Depending on the implementation of the matching system and clearing house, the risk of greater administrative burden and bureaucracy due to funnelling all communications via a third party rather than directly with PCSs (minor). The magnitude of this impact depends on how the clearing house would operate. It is possible that by centralising tasks such as issuing communication requests and reporting problems with the collection, information would need to be relayed through a third party rather than delivered directly to the PCS responsible. As a result, PCS response may slow down, and it could lead to additional effort and costs from the LAs before the issue is resolved. Alternatively, the matching system could maintain direct links between PCSs, LAs (and other DCF operators) and AATFs which would avoid this cost implication. However, the latter scenario could come at a minor cost of additional administrative burden for the clearing house to obtain data from various stakeholders.

Related to the above, bespoke contracts would be replaced by standard agreements, and therefore additional assurances must be put in place. To establish and enforce a UK minimum service level agreement, LA representatives would need to be engaged and their time diverted away from other tasks. This is a non-monetary impact classified to be of moderate-level impact since it relates to a core function of LAs.

Benefits to LAs

Matching would benefit the LAs in three aspects:

- **Cost savings in not having to undertake tender exercises (significant)**: this represents a step change in the way LAs current manage contracts;
- Potential access to a central fund for reducing loss of WEEE (moderate to significant);
- Potential inclusion of social value or other forms of bespoke arrangements justified by the full net cost principle in the national service level agreement in a standardised manner (moderate).

In addition, for LAs that are currently served by the PBS, matching could offer a more stable and potentially less onerous option if the algorithm is designed to minimise the number of contact points for these LAs. This is a moderate impact as it relates to a core function of LAs.

6.4.4 Impact on waste management companies

For WMCs that also operate LA DCFs, the same costs and benefits discussed above for LAs would apply. In addition, there are costs specific to vertically integrated WMCs if their DCFs are not matched to their in-house PCS operation.

Cost from needing to seek out additional sources of WEEE or rely more on buy-out options such as evidence purchases and compliance fees (moderate to significant): For a vertically integrated WMC, matching could disrupt its supply chain of WEEE from DCFs all the way to AATFs. Whereas in the current system all WEEE that is handled by a vertically integrated WMC is automatically obligated[34], under matching a proportion of these evidence notes issued by the WMC-controlled AATFs would be attributed to a competing PCS instead. If a weight-based target and compliance fee mechanism is maintained, this means that the WMC would need to either seek out additional sources of WEEE (assuming matched

[34] Mark Hilton, Orla Woods, and Alice Johnson, 'Electrical and Electronic Equipment: Ingredients for Successful Extended Producer Responsibility'.

WEEE alone fall below the target) or rely more on buy-out options. Both scenarios involve a moderate to significant cost increase.

Cost of needing to develop new relationships with other PCSs to secure supply of WEEE to its own AATFs (minor to moderate): This involves a transition cost (minor) and potentially a recurring cost (moderate) for the input materials compared to the current operation. This is because some of the WEEE that is currently automatically routed to WMC-operated AATFs could be redirected to competing facilities instead. The likelihood of this risk depends on the commercial appeal of WMC-controlled AATFs and their working relationships with PCSs matched in the area.

6.4.5 Impact on Approved Authorised Treatment Facilities

Costs to AATFs

Depending on the implementation of the matching system and clearing house, the biggest concern for AATFs is the potential dip in revenue if known risks are left unmitigated during implementation of matching and lead to less WEEE collected overall (minor to moderate): During the transition period, there could be a temporary dip in collection (a minor cost implication). If known risks remain unmitigated beyond the transition period, then there could be moderate and persistent cost implications for AATFs, which would also vary depending on the streams of WEEE affected. For instance, the impact of matching on the collection quantity and quality of LDA and certain SMW would be critical to AATFs as these streams are more profitable.[35] If kerbside collection becomes mandated after matching, further work should be undertaken to ensure WCAs and the WEEE they collect are reliably and fairly managed under matching.

In addition, similar to WMCs, AATFs should also expect transition costs for developing new relationships with PCSs matched in the area and establishing new logistic arrangements with DCFs, though the latter cost is likely to be passed onto the PCSs. Both costs are categorised as minor given their temporary nature. Depending on the level of demand, AATFs may also see the need to invest in collection and treatment assets, which would have a long-term impact (moderate to significant). This cost is also likely to be at least partially passed onto the PCSs.

Benefits to AATFs

A key benefit perceived by AATFs is the potential for longer-term contracts with PCSs under a matching system designed to foster stability. Matching by collection points would remove the need for PBS and therefore the AATFs would have better visibility and certainty over which PCSs are operating in the area. On this basis, AATFs could develop improved value propositions and secure longer-term agreements. Stakeholders have also highlighted that a more stable system potentially achievable through matching would create more favourable conditions for investment planning, which is advantageous for all stakeholders if it leads to higher treatment qualities and more value retained from WEEE. These are non-monetary benefits. Their impact levels are not categorised as they relate to the strategic decisions specific to each AATF.

[35] Mark Sayers, 'Evaluating Opportunities to Establish an Investment Fund for WEEE Infrastructure'.

6.4.6 Impact on environmental regulators and government

Costs to environmental regulators and government

The subsistence fees received by environmental regulators and government could drop, depending on their cost structure **(minor to moderate)**: if regulators' WEEE-related costs are mostly variable costs, i.e. dependent on the number of PCSs (e.g. administrative tasks and liaising with individual PCSs where needed), then the impact would be minor as the fees payments from each PCS would still cover the costs incurred by the regulators. On the other hand, if the regulators' WEEE-related costs are mostly fixed costs, i.e. independent of the number of PCSs, then the current overall fee level would remain unchanged. For regulators to ensure cost coverage, this could translate to an increase in annual charges to the remaining PCSs.

Environmental regulators and governments should also expect to expend resources on developing a harmonised approach to WEEE so that the clearing house would only need to enforce one set of rules and a common algorithm across the UK **(moderate to significant)**: government bodies such as DEFRA would borne the cost of consultations, and environmental regulators should expect costs for introducing and implementing measures to oversee matching. Cost to the public authorities would depend on the scale of consultations and changes for regulators. This cost is separate from the cost of establishing the coordination body, which would be borne by producers.

Benefits to environmental regulators and government

The public authorities could benefit from transferring some administrative responsibilities (and costs), such as reporting POM and collection data, to a clearing house funded by producers (moderate): Since a clearing house would require POM and collection data from each DCF in order to run the algorithm, this transfer of responsibility could reduce duplicated efforts and costs. Note that this could come at a minor transition cost for managing internal changes and establishing new protocols for overseeing and collaborating with the prospective clearing house.

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8 Annex: Additional details from territory interviews

What was the purpose of setting up a matching process/clearing house?

ITALY: Coordination was required in order to ensure that all country regions are covered in a fair and efficient way, with stable market prices, and to avoid "selective collection" of preferred collection sites and specific WEEE categories.

SLOVENIA: Financial clearing was set up in order to resolve any occurring imbalances in collection figures compared to the PCSs´ market share.

FRANCE: The clearing house was set up because:

- Municipal collection points are not supposed to financially benefit from WEEE collection due to their being a public system. By setting agreements with the clearing house, the collection points receive a compensation for their services from PCSs, as approved by the government.
- It allows for coordination to service all collection points, to avoid selective collection and to regulate the fees paid to municipalities.
- It provides a pool of resources to handle common points of interests and research topics among the PCSs.

SWEDEN: One of the PCSs did not fulfil their collection responsibility, which led to the government's decision that the PCSs must work together to fulfil the collection responsibility equitably.

IRELAND: The clearing system allows the government to meet the national collection targets, and the two PCSs to increase their operational and management efficiency. The government required a coordination system, and the two PCSs established the logistics.

SPAIN: Matching was a private initiative set up by the PCSs. The aim was to set up a central platform to gather collection data and assign collection facilities by the market share of the PCSs. The clearing house also discusses other matters, for example policy issues.

Originally, the public authority suggested a clearing house as a coordination centre to manage collections from municipal collection points by the PCSs, but this was not set as a legal obligation.

The initiative was also pushed by the regional authorities as they see benefits in having a clearing house that would coordinate with municipalities and support the advertising campaigns in the regions (though not on national level since WEEE is within regional territories).

GERMANY: The clearing house was set up as a neutral and independent entity to avoid conflicts of interest in terms of WEEE recycling and logistics. The registration of EEE producers or authorized representatives ensures that the producers are taking responsibility for their EEE, especially the responsibility for recycling and disposing of these according to the WEEE legislation (ElektroG). EEE from private households is collected in containers provided by the örE (public waste disposal authorities). Most producers manage their extended producer responsibility directly, without the support of a PCS.

AUSTRIA: After the implementation of the first WEEE Directive, the Ministry of Environment decided it was necessary to create a body that would coordinate the collection of WEEE in order to meet the national collection target. In the end only a minor amount of the total collected waste is going through the clearing house – the rest is handled through private contracts.

DENMARK: DPA was set up by the public authorities, under the Environmental Protection Act (which is the Danish implementation of the WEEE Directive) to ensure high quality data collection, which could then produce statistics to inform on the EU WEEE Directive targets. The system also, using an algorithm, coordinates the equitable distribution of municipalities. The organisation is privately financed but regulated by the Ministry of Environment and the annual budgets must be approved by the EPA.

UK: A mandatory system was introduced in order to ensure a national coverage of WEEE offtake and to manage orphaned WEEE (i.e. streams that are not covered by private contracts): this system allows local authorities typically in commercially unattractive, remote locations have some or all of their WEEE streams collected by a PCS, with the costs split between PCS members of the PBS by market share.

ILLINOIS: The previous scheme, based on a 2007-08 law, used a tonnage-based goal requirement for producers that resulted in some collection points not being consistently served (for example, producers would stop collecting WEEE when their target was reached). In addition, there were fluctuations in the actors' responses to the system (different actors felt the goal was set incorrectly). Moreover, the average weight of new EEE POM tends to decrease and therefore, if goals were set based on tonnage of POM this would not equitably balance with products at the end of life which were older and heavy. Counties and producers aimed at a scheme that did not include a collection goal.

This led to agreeing to use a clearing house, where all of the quantities inputted into the system will be collected by the producers in an equitable way, ensuring all producers are paying their fair share.

The new system removed collection targets for producers. Since the targets are linked to the weights of EEE POM in previous years, this also prevents fluctuations in weight-based collection targets due to the weight changes from product designs.

NORWAY: Clearing was pushed by both the government and the industry in order to avoid PCSs that have met their targets early in the year to stop collecting (which happened in 2012). One of the country's PCSs, initiated the discussion on the interpretation of the waste regulation. After discussions with the other PCSs a common agreement that includes the rules of balancing – code of conduct- was set up. Currently, the environment agency has access to general information of the process but is not directly involved.

What is the government involvement in the set-up or operation of the matching process/clearing house?

The transposition of the WEEE Directive in each member state creates the legislative basis for coordination. Additional legislations that support coordination include for example France's new regulation issued in February 2020, which states that when multiple PCSs are in place, the government can enforce a coordination body.

ITALY: The Environment and Economic Ministries have a supervisory role of the clearing house operation, but they are not involved in the clearing house's operations or decision making.

SLOVENIA: The financial clearing does not require government authentication. The government provides minimal to no supervision unless there is legal action taken.

FRANCE: The government is part of the decision making board that sets the matching equilibrium and actions required to correct collection deviations. In addition, the government sets the tariffs that the PCSs pay to LAs to access WEEE. The clearing house is managed and owned by the PCSs but is accredited by the government.

SWEDEN: EPA assisted in the cooperation between the PCSs to design the private compensation agreement.

IRELAND: There is ministerial approval under the applicable Producer Responsibility Initiative Regulations. The government has had a place on the board of directors since 2015, and was previously an observer to the Committee of Management. The government ratifies decisions made by the PCSs and can enforce arbitration.

In addition, the government levy money from the PCSs, which is shared proportionally to the market share of the PCSs and mandates the PCSs to make a payment contribution to the LAs and EPA.

SPAIN: There is no government involvement in the currently operational clearing house.

GERMANY: The national register for WEEE was founded by producers as their clearing house (Gemeinsame Stelle) for the purposes of the Electrical and Electronic Equipment Act (ElektroG). It was entrusted with sovereign rights by the Federal Environment Agency (UBA).

AUSTRIA: The ministry of environment is a member of the supervisory and the advisory board of the clearing house.

DENMARK: The DPA system is regulated by the government through the Danish interpretation of the WEEE Directive Implementation Act. The Ministry of Environment continually governs the DPA, through defining the board of the system and assigning the chairman of the Board. The Ministry expanded the DPA in 2009 to incorporate ELV and batteries.

ILLINOIS: The clearing house submits a proposed matching allocation overview report annually to the state. Consequently, the state suggests adaptations and provides a final approval of the subsequent year set allocation.

NORWAY: The Environment Agency overviews but does not interfere with the clearing process.

Background information of matching systems

Table 13 Background information of reviewed matching systems

Country	Category of WEEE	Scope of WEEE	Year of set up
Italy	All domestic categories and lamps	Household B2C from municipalities and retailers	2007
Slovenia	All domestic categories	All B2C and B2B	2016
France	large household refrigeration equipment (GEM F), large household equipment, (GEM HF), screens (ECR), small mixed appliances (PAM)	Household B2C from municipalities	2006
Sweden	All domestic categories	Household B2C from municipalities and retailers	2008
Ireland	All domestic categories	Household B2C from municipalities and retailers	2006
Spain	All domestic categories	Household B2C from municipalities	2007
Germany	All domestic categories and batteries	Household B2C from municipalities	2005
Austria	All domestic categories and batteries	Household B2C from municipalities and retailers	2005
Denmark	All domestic categories, batteries and end of life vehicles	Household B2C from municipalities	2005
UK	All domestic categories	Household B2C from municipalities	2016

Illinois	B2C, and selected categories of IT/Consumer electronics: • Computers/small scale servers • Computer monitors • TVs • Printers/fax machines/scanners • DVD/VCR/DVRs • Games consoles • Cable and satellite receivers • Keyboards/mice/ portable music players	Household B2C from municipalities	2018
Norway	All domestic categories	All B2C and B2B	2013

Is the clearing house publicly or privately funded?

ITALY: The clearing house is a private institution financed by the PCSs. All PCSs are required to join the clearing house.

SLOVENIA: It is a private agreement between the PCSs rather than a formal system. The government initiated the idea of the system, and the official introduction and logistics of operation was implemented by the PCSs. It is a voluntary system, and not all PCSs participate on a constant basis.

FRANCE: The clearing house, OCAD3E, is a private system accredited by the authorities. It is owned by two PCSs (Ecologic and Ecosystem) that operate as 50/50 shareholders. It is mandatory for all PCSs to serve all collection points.

SWEDEN: It is a private compensation methodology between the two PROS of the country: El-Kretsen and Recipo.

IRELAND: It is a private company limited by shares from 2015. A protocol was determined by the two PCSs in the country and was ratified by the government.

SPAIN: The clearing house, named OfiRaee, is a private initiative by the PCSs which is recognised as a coordination body by the government. It does not have a legal entity but it is a common and voluntary agreement among the PCSs. Two private enterprises have been appointed by the PCSs to manage an online platform and provide technical assistance to users and PCSs.

GERMANY: Germany's stiftung EAR was founded by producers and producer associations but was given sovereign rights resulting from the ElektroG (Elektro und Elektronikgerätegesetz - German transposition of the WEEE directive) and is now also acting as an authority.

AUSTRIA: The clearing house is a private company owned by some public company shareholders. The institution is authorised by the ministry to operate as a private company.

DENMARK: The DPA system, which is short for Danish Producer Responsibility System, is a self-governing, non-profit organization. It is privately financed but regulated by the Ministry of Environment. The annual budgets must be approved by the Environment Protection Agency (EPA).

UNITED KINGDOM (UK): PBS (Producers Balancing Scheme) is a voluntary initiative initiated by the PCSs which was incorporated into national legislation on 1st January 2019. It is an initiative led by the WEEE Schemes Forum (WSF). In August 2019, it became mandatory for all the UK Producer Compliance Schemes (PCSs) that collect household waste to join the PBS. It is funded by the PCS members through the WSF.

ILLINOIS: It is a not-for-profit pre-established entity of the producer trade association.

NORWAY: It is a privately funded system.

What is the annual budget for the clearing house?

The budgets are not directly comparable between the territories, due to the variation of the matching systems and the different roles undertaken by the clearing houses. This section outlines the average annual budgets of the matching systems in Italy and France to show the variation of the costs rather than to directly compare between the two.

Who paid for the set up costs, and who pays for the operating costs of the clearing house (in Italy and France)?

The clearing house consists of five members of staff (including finance and communications, the IT manager, reporting, operations, and technical support), an IT mechanism for allocation and a third party call centre that is not part of the organisation, but it is managed by the clearing house.

In Italy, the annual budget is around € 1.2 million p.a. - with the following breakdown:

- 50% labour costs,
- 5% communications
- 8% consulting costs
- 8% operational costs
- 16% subcontracting (IT, call centre)
- 2.5% taxes
- 2.5% internal investments
- 8% other

There was an initial investment of below €500,000 for the IT system. The running costs are €1.5 million p.a. including IT development but excluding money paid to the LAs and retailers when the WEEE is collected. The cost of contribution to the collection sites is €30-40 million p.a.

- Set up: under €2 million, which included: initial set-up and IT development
- IT initial investment: below €500,00 (only for IT platform)
- Operating costs: €1.5 million p.a. not including fees paid to LAs and retailers
- Total contribution: €30-40 million p.a. (this is part of the agreement)

In France, the budget is approximately €1 million p.a. of which €200,0000-300,000 is spent on managing municipalities. The other 70% is spent on the technical side of OCAD3E including research and development (R&D), legal issues, processes of collection and other elements. Other activities include project management; there are 3-4 projects managed at one time shared through OCAD3E but funded by the PCSs and managed by PCS staff and consultants.

OCAD3E is a two-person company, one member from each PCS, and the tasks are subcontracted. The subcontractors are responsible for administration work; they adjust errors, track the contracts with the LAs (there are 1200 contracts for 900 municipalities), and the quantities (tonnes) of WEEE collected. The fees paid to municipalities through OCAD3E are 30 million euros.

There are 4 to 5 subcontractors employed, and they are paid €200,00-250,000 p.a.

- Costs are set matching that of the equilibrium of the shareholders (around 70% ecosystem, 30% ecologic). Average financial support for municipalities from OCAD3E (collection facilities, charges, dedicated staff etc.) = 60 €/tonne. For municipalities enforcing measures to secure WEEE, additional support = 10 €/ton. €1.3 million was spent since January 2010, €700,000 spent in 2012.

Resources required for matching in other territories

In Sweden, there is no formal IT system to calculate the responsibility between the two PCSs, but rather spreadsheets per category of WEEE are being used.

In Ireland, there is one employee from each PCS that dedicates approximately 50 hours annually to the system. There would be more funding required if arbitration occurred, but so far, any issues are resolved during discussions. The cost for the auditors is shared based on market share. Some overhead costs are shared: PR and marketing; payments to the LAs that are not tonnages based (for the operation of CA sites, charged by year)- are allocated by market share. All remaining tasks are internal.

In Spain, consultants were used to set up the system and two private enterprises (Sistemas Medioambientales and PRONET) operate the IT system and the call centre to provide technical assistance to users and PCSs. Set up costs: €301,000; Operating costs in 2020: €3.8 million for storage to municipalities.

In Germany, there is an individual IT system developed and programmed including software and hardware, 35 members of staff, and two separate IT facilities. Set up costs: DE- 6 Mio. EUR in two years (August 2003-August 2005) Operating costs: about €8 million p.a. (incl. WEEE and Batteries). Highest cost item: IT (hardware + software); outsourced centres hosting the hardware and specialty software (developed from scratch); software is now at 3rd version. Issues with previous software versions: less reliable/responsive for user.

In Austria, the system requires an IT platform for municipalities to coordinate pickup of allocated WEEE and to provide a basis for the funding of any public relations projects. The system has also established an electronic data management system that has many functions including the registration of all actors, quarterly reporting of the total POM by PCSs, and annual reports of collection data. The organisation has an office with 6 employees. The staff include the managing director, assistant, commercial, financial controller, and 2 material flow analysis staff. Operating costs: €800,000-900,000 p.a. to manage the CH – staff, offices etc.

In Denmark, an algorithm was created to allocate collection points which includes all the allocation principles. The algorithm uses the collection and POM data reported through the IT System. There are 20 to 30 members of staff at the DPA-System.

In Illinois, the 3 key areas for operating costs are: legal, insurance and payment of a separate organisation (National Center for Electronics Recycling) to run the administrative tasks of the clearing house. Although the clearing house is owned by the ERRO,the ERRO sets the rules for the programme but does not perform any administrative tasks. The costs of operating the clearing house are divided between the producers based on their obligation rates. The total cost of running the clearing house is approximately $200,000-$250,000. Producers also pay a $5,000 flat fee to register with the EPA to finance the oversight and approval duties of the government. The obligation rates are then tiered per whole number percentage to calculate the fee e.g. if an obligation rate is greater than or equal to 5%, a $4,000 annual fee is set.

Who is reporting to the clearing house?

This question does not apply to Slovenia, Sweden and Norway due to the absence of a clearing house.

ITALY: The PCSs report the collected amounts per year and the collected amounts per month to the clearing house. The collection points send pick up requests, and the AATFs report on the quantities collected and managed.

FRANCE: The PCSs report POM and quantities of WEEE collected to the clearing house, the collection points send pick up requests, and the regional/local authorities send the invoices to be paid.

IRELAND: The producers report POM to the clearing house and PCSs report the costs and collected amounts.

SPAIN: The PCSs report POM annually and collected amounts monthly to the clearing house, and collection points send pick up requests.

GERMANY: The producers report to the clearing house the B2C-EEE POM monthly and the quantities of B2C WEEE collected, B2B POM and B2B quantities collected yearly. The collection points send pick up requests, while the retailers report the quantities of B2C collected yearly. The regional/local authorities report the quantities of B2C-WEEE, in case they opt-out for, monthly, and the AATFs the collected amounts annually.

AUSTRIA: The PCSs report the POM per month, the collection points send pick-up requests to the clearing house, and the AATFs report the actual amount of WEEE collected.

DENMARK: The PCSs report POM and quantities of WEEE collected to the clearing house and the retailers report the amounts of WEEE collected.

ILLINOIS: The producers report POM to the clearing house, the PCSs report the collected amounts from CPA and other sources quarterly, and the clearing house submits the annual plan to the EPA to approve on an annual basis.

UK: The PCSs report the tonnage and cost of collecting the WEEE quarterly to the PBS, collection points send service requests, the EPA sends the PCSs market share, and the AATFS provide PBS with evidence notes for treating the WEEE.

Governance of the clearing house – Board, supervisors and decision making

ITALY: The board of the clearing house is comprised of a representative from each member PCS. The main tasks of the assembly include deliberations on management, general actions for the clearing house, discussion on approval of the budget and other documents proposed by the Executive Committee. Every two years, the board also elects 3-7 members of the consortium to become the Executive Committee. The Executive Committee manages the day-to-day tasks of the clearing house and prepares documents to be submitted to the Board e.g., budget, quota for annual contributions to be paid by consortium members and the final balance of the clearing house. The Committee also deliberates on new consortium members and defines the internal actions of the clearing house.[36]

SLOVENIA: In Slovenia there is no formal clearing house, and all decisions are made through discussions between the PCSs.

FRANCE: The board of the clearing house is comprised of the 2 shareholder PCSs, who aid in the daily operations of the clearing house. The decision-making body is the 'Comité de Conciliation' which is comprised of the board, representatives from the government and 3 organisations representing the municipalities. The key tasks of the Comité are managing the equilibrium of the allocation system and to implement balancing to correct deviations in set market shares and collection rates.

SWEDEN: In Sweden there is no established clearing house and decisions are made between the CEOs of the 2 PCSs. Any conflict resolution includes the 2 CEOs and the EPA.

IRELAND: All decision-making is made by a representative from each of the 2 PCSs and is ratified by the government.

SPAIN: There are regular meetings between all PCS members, with a coordinator for the meeting being from one of the PCSs. These meetings consist of supervision and decision making regarding the system.

[36] 'Governance - CdC WEEE', accessed 17 August 2021, https://www.cdcraee.it/GetPage.pub_do?id=2ca980954c369c25014c50890cf0604c.

Although regional representatives are not involved in the governance or decision making, they do meet with the CH and PCSs in discussion workshops.

GERMANY: The Clearing House is represented by the Managing director, who manages the day-to-day operations. The organisation also consists of 2 main boards. The supervisory board is comprised of 6 representatives who are executives from registered producers. The advisory board is comprised of representatives of the producers and the distributors, the örE, the Federation and the Federal States, the Ministries etc. Stiftung Ear is then divided into three departments (Legal, IT and Accounting).[37]

AUSTRIA: The Clearing-house leadership is comprised of a general assembly, board and advisory board.

DENMARK: The Clearing House is managed by a board that is comprised of 7 members appointed by the minister of environment; these are suggested by 6 industrial associations. The chairman of the board is one of these 7 members and is appointed by the Minister. The board appoints a director of the clearing house to manage the day-to-day operations of the Clearing House.

ILLINOIS: ERRO is the owner/host of the clearing house that subcontracts out tasks and sets rules for the system that supersede the legal basis. The administrator of the clearing house is the national centre for electronics recycling.

UK: The administrator of the PBS system is Anthesis; WSF Ltd is the operator of the system.

NORWAY: In Norway there is no formal clearing house, and all decisions are made through discussions between the PCSs. The rules of financial clearing are set out in an agreement between the PCSs and approved by the EPA.

Summary of roles and responsibilities of a clearing house

Depending on the needs of the wider system, the remit of a clearing house can extend beyond only administering matching. Table 14 summarises the range of roles and responsibilities uncovered in the interviews. The core tasks of the clearing house (in bold) are focused on running and maintaining the algorithm for matching, monitoring the overall system productivity, and overseeing the financial or physical balancing of the matching system (in cases where a PCS collects more or less than their allocated share due to fluctuations in supply of WEEE). It should be noted that the list is not exhaustive; only duties/tasks discussed with the interviewees are included.

Table 14 Summary of roles and responsibilities of clearing houses in reviewed territories

Potential tasks for a clearing house	Number of clearing houses delivering the task*
Administration of the matching process	
Calculate and document contribution/fees to municipalities according to amounts/quality collected	3
Reallocate DCFs according to changes in PCSs' market shares	**5**
Set the allocation principles to ensure equitable distribution of municipalities	**8**

[37] 'Managing Director and Departments', Stifung elektro-altgeräte register, accessed 17 August 2021, https://www.stiftung-ear.de/en/about-us/organisation/managing-director-and-departments.

Data collection and analysis	
Organising and managing IT System used by stakeholders to report collection data	**8**
Collect relevant information from actors within the system that are not involved in the matching system to ensure correct handling of WEEE e.g. Tonnages of WEEE treated from AATFs	3
Organise and manage registers of stakeholders (AATFs, PCSs, Producers) to ensure a standardised quality of service.	**6**
Calculating producer/PCS responsibility of obligated collection based on the POM data of the producers (and aggregated POM of producers registered to each PCS).	**8**
Monitor PCS collection data against set responsibility to ensure PCSs are not over/under collecting	**8**
Using data collected to produce robust reporting to inform against national targets.	2
Forecasting of collection quantities for updating the algorithm	2
Allocate collections (pick-ups or sites) by algorithm/negotiation	**8**
Process data submitted by PCSs and LAs on existing relationships and preferred allocated partner	1
Rule enforcement and quality control	
Ensure PCS is in a sound position to take on collection obligations	1
Supervising/Establishing audit programmes	3
Ensure all producers (above de minimis threshold) are in PCS or have established individual collection systems	1
Communication	
Acting as an intermediary point for contact between the PCSs and LAs/retailers/AATFs associations	3
Provide a singular and stable interface to LAs	3
Harmonise communication for household WEEE through projects and public campaigns	**5**

Management of call centre	2
Annual reporting of current data/contracts/findings from funded projects	**4**
Contracts	
Setting contracts between the PCSs and other actors within the system	3
Provide economic compensation to LAs/retailers when conditions outlined in contracts are fulfilled.	3
Determining and providing compensation to municipalities or municipal associations for public communication campaigns	1
Knowledge	
Establishing a platform and research framework for topics of common interest for the sector (e.g. waste prevention and eco-design)	1
Administrative tasks	
Administration of visible fee levels	1
Provide a dedicated lawyer to engage in legal actions for municipalities.	1
Back office administrative tasks (e.g. centralise documentation, minuting meetings, etc.)	1
Represents the interests of the PROs in some situations e.g. cases with the ministry	1
Financial	
Provide financial support to ensure adequate security at MCPs to mitigate the risk of theft	1
Administer penalties to respective stakeholders if contracts are broken	1
Allocate the overhead costs to be paid to environment agencies and local authorities, costs are allocated to PCS' based on the comparative cost of operations of each PCS respectively.	1

*(if >3, bolded as core tasks)

Contractual duties of stakeholders

Insufficient evidence was obtained to provide a comprehensive understanding of contractual duties for each stakeholder within each system. Contractual duties information is also limited as some countries are based on the legislative duties of stakeholders (Denmark, Norway and Germany). For financial clearing, the contractual duties of the stakeholders will remain as financial agreements. However, where a clearing house is established, it will play a role in the contractual duties between the stakeholders. Therefore information provided is limited to duties that directly or indirectly involve the clearing house through contracted responsibilities.

Contractual duties of PCSs

PCSs must fulfil duties set out in contracts set with either municipalities or retailers (providing containers, organising collections and payments for services). PCSs must also submit data to the relevant stakeholder in the contracted amount of time. If not already mandated in the legislation, PCSs will be contractually obligated to collect all WEEE, although through contracts with PCSs it is often stated that the assigned collection points must have all collections covered by the PCS.

Contractual duties of other stakeholders

Generally, the duties of municipalities are outlined through contracts with PCSs related to tasks regarding on site WEEE or requesting payments/resources at sites. Municipalities must fulfil activities set out in their contracts, from the physical activities related to the WEEE at any collection points but also reporting of collection data to the clearing house. Where applicable, municipalities must also submit pick-up requests and subsequent invoices to the relevant stakeholder (PCS or clearing house). In some regions municipalities must opt-in/opt-out of the system if they are not legally obligated to join the allocation system.

Retailers often participate in private contracts but are still required to report collection data (either to PCSs or to the clearing house). If included within the scope of matching, the contractual duties will mirror those of the LAs, relating to reporting etc.

Information on the contractual duties of treatment operators is largely unavailable, some interviewees did state that the only tasks for treatment operators were to report treatment data to either the PCS or the clearing house.

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