



**Smarter Regulation of Waste in Europe
(LIFE13 ENV-UK-000549)
LIFE SMART Waste Project**

Action B4:

Horizon Scanning Toolkit

Prepared by Cranfield University
31 January 2018

This report was prepared with the contribution of the LIFE financial instrument of the European Union

AN EU LIFE+ PROJECT FOR 2014–2019

Version 1.0



Executive Summary

One of the objectives of the LIFE SMART Waste project is to identify how environmental regulators can use horizon scanning processes to build an early warning system for emerging developments in the waste sector to protect the industry from future criminal enterprise.

The Horizon Scanning Toolkit provides a suite of tools to achieve that objective. It is a practical guide that regulatory bodies and their partners can use to:

- build intelligence about waste crime by gathering, organising and sharing weak signals of change
- create insight into changing criminal behaviours and patterns of crime through assessing, ranking and deepening their understanding of the implications of those weak signals
- work together to research, plan and deliver action to protect consumers and the industry now and in the future

The toolkit provides a structured approach to horizon scanning that builds a clear, consistent and shared perspective of emerging developments in the waste sector and their potential for criminal enterprise.

Through using the toolkit, regulatory bodies will learn to spot newly emerging trends quickly and to assess what the emerging opportunities for future waste crime are likely to be. They will then be able to act together to minimise the impact of those crimes on the environment, society and business.

LIFE SMART Waste

The Horizon Scanning Toolkit

Tools for Managing the Future

Guidance for Users



Version 1.0
22 January 2018

Contents

| | | | |
|--|-----------|---|-----------|
| 1. Introduction | 4 | Annexes | 26 |
| 2. Overview of horizon scanning | 5 | 1: Glossary of horizon scanning terms | 27 |
| Horizon scanning | 5 | 2: Using Pearlrees to organise your scans . . | 29 |
| The three horizons model..... | 6 | 3: Sample scanning paper | 30 |
| Focusing on weak signals | 6 | 4: Sample Ranking Insights workshop agenda | 41 |
| 3. Overview of the horizon scanning toolkit . . | 7 | 5: Methodology for scoring the scans | 42 |
| Introduction | 7 | 6: Sample workshop task sheets | 44 |
| Aim of the Toolkit..... | 7 | 7: Sample output from a scanning workshop exercise | 49 |
| The nine step model | 9 | 8: Project planning flow chart | 51 |
| 4. Managing the horizon scanning process . . | 10 | 9: Building a case for action | 52 |
| Introduction | 10 | 10: About the authors | 53 |
| The process manager | 10 | | |
| Scanners..... | 10 | | |
| Workshop participants | 11 | | |
| External experts..... | 11 | | |
| Project champions | 11 | | |
| The horizon scanning champion..... | 11 | | |
| A continuous process..... | 11 | | |
| 5. Tools for building intelligence | 12 | | |
| Gathering intelligence | 13 | | |
| Organising intelligence | 15 | | |
| Sharing intelligence | 16 | | |
| 6. Tools for creating insight | 17 | | |
| Assessing insights | 18 | | |
| Ranking insights | 19 | | |
| Deepening insights | 21 | | |
| 7. Tools for delivering action | 22 | | |
| Researching action | 23 | | |
| Planning action | 24 | | |
| Delivering action | 25 | | |

1 Introduction

One of the objectives of the LIFE SMART Waste project is to identify how environmental regulators can use horizon scanning processes to build an early warning system for emerging developments in the waste sector to protect the industry from future criminal enterprise.

The LIFE SMART Toolkit provides a suite of tools to achieve that objective. It is a practical guide that regulatory bodies and their partners can use to

- build **intelligence** about waste crime by gathering, organising and sharing weak signals of change
- create **insight** into changing criminal behaviours and patterns of crime through assessing, ranking and deepening their understanding of the implications of those weak signals
- work together to research, plan and deliver **action** to protect consumers and the industry now and in the future

The toolkit provides a structured approach to horizon scanning that builds a clear, consistent and shared perspective of emerging developments in the waste sector and their potential for criminal enterprise. Through using the toolkit, regulatory bodies will learn to spot newly emerging trends quickly and to assess what the emerging opportunities for future waste crime are likely to be. They will then be able to act together to minimise the impact of those crimes on the environment, society and business.

The toolkit has 7 sections:

- Section 1 introduces the Toolkit
- Section 2 provides an overview of horizon scanning
- Section 3 provides an overview of the Toolkit
- Section 4 provides guidance on how to run the horizon scanning process
- Sections 5-7 set out the tools and how to use them
 - Section 5 describes the tools for building intelligence
 - Section 6 describes the tools for creating insight
 - Section 7 describes the tools for delivering action

There are ten annexes

- Annex 1: Glossary of horizon scanning terms
- Annex 2: Using PearlTrees to organise your scans
- Annex 3: Sample scanning paper
- Annex 4: Sample workshop agenda
- Annex 5: Methodology for scoring the scans
- Annex 6: Sample workshop task sheets
- Annex 7: Sample output from a scanning workshop exercise
- Annex 8: Project planning flowchart
- Annex 9: Building a case for action
- Annex 10: About the authors

2. Overview of horizon scanning

Horizon scanning

Horizon scanning is a systematic process for capturing and monitoring change. The process identifies emerging issues that are on the periphery of current thinking and planning, and provides early warning of how trends and developments may lead to changes in behaviour and create new challenges and opportunities in the market place.

Scanning is an important tool that helps users to develop an understanding of the key drivers of change, how they might develop in the future, and how they might create new opportunities for consumers, businesses and – in the case of waste crime – criminal behaviours. For policy makers, horizon scanning is a key tool for anticipating future behaviour and developing future interventions in response to anticipated challenges and opportunities.

There are three stages in horizon scanning:

- Gathering intelligence about a wide range of change
- Using risk analysis to identify what changes are likely to be important for society and the industry and to identify their potential impact
- Making sense of how these changes are likely to shape the market and change the behaviour of key players in it; and, by doing so, making sense of how policy makers and regulators need to adjust policies and practices in response to these changes

The aim of horizon scanning is not to predict what will happen but to gather signals of change that, taken together, provide insights into the future development of (in this case) waste crime and criminal behaviour.

Horizon scanning

A **continuous process** of searching for emerging issues and trends

A **systematic process** for gathering information, documenting and communicating detected evidence

A **participatory process** for collecting, interpreting and synthesising information to inform decision-making

The three horizons model

The conceptual model that underpins horizon scanning is the three horizons model (Figure 1), which defines three time frames for thinking about the external trends and developments which might impact on an organisation's strategy.

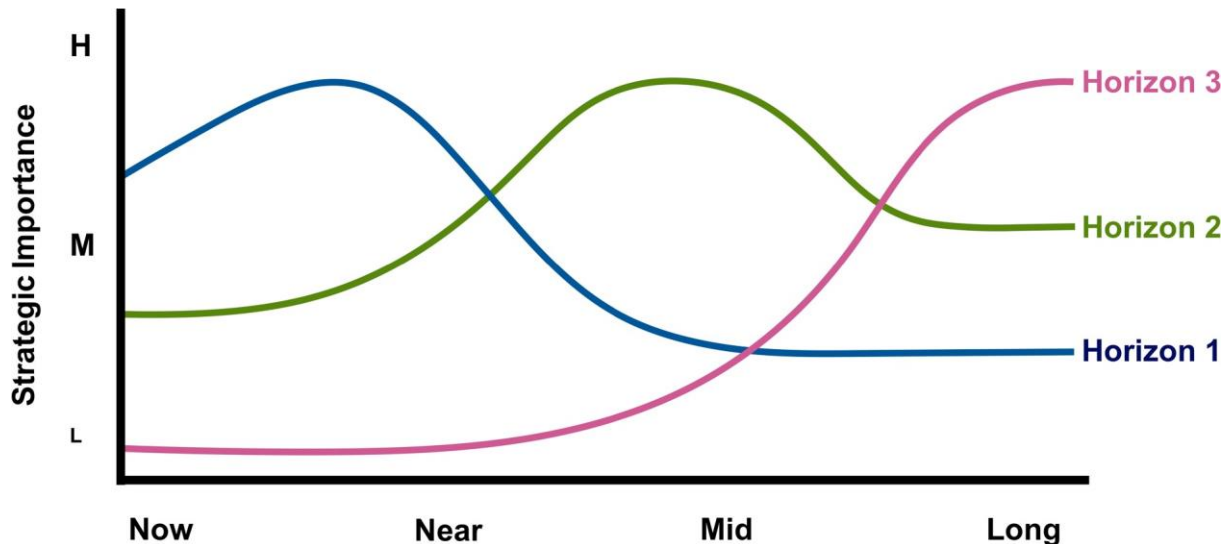


Figure 1: The three horizons model

Horizon 1 (H1) is the present and the near future. H1 issues are strategically important now. They are visible and well understood and are generally the issues that the organisation is already responding to. H1 issues are therefore the focus of current policy and strategy.

Horizon 2 (H2) is the less immediate future. H2 issues are less well characterised and the organisation may not yet be fully aware of them or their implications for policy and strategy. By their nature, horizon 2 issues are less urgent; so even when organisations do become aware of them, they may not respond immediately, preferring to wait and see how the issues develop.

Horizon 3 (H3) is the mid to long term future. H3 issues can be difficult to characterise in detail since they are the long run outcome of a range of factors, some of which may not be fully in play. Tracking horizon 3 issues is therefore important for organisations who want to spot emerging opportunities and threats and anticipate how to respond to them quickly.

The main focus for horizon scanning is the mid to long term: Horizon 2 and Horizon 3. There is no fixed definition of what 'mid to long term' means with the timeframe defined on a project by project basis.

Focusing on weak signals

It is often easy to understand what is happening in the present and near future. Important H1 trends and events stand out against the background and their impacts are clearly signalled to policy makers. The further forward scanners look, however, the weaker these signals become and the harder it can be to spot what they mean for the future development of waste crime and criminal behaviour.

The horizon scanning process is designed to identify these weak signals and, by gathering them together, to help policy makers and regulators understand how they are likely to shape future waste crime activities – and, consequently, the future policy and regulatory response.

3. Overview of the horizon scanning toolkit

Introduction

The toolkit is designed for environmental regulators who want to use horizon scanning to build an early warning system to protect industry from future criminal enterprise.

It is designed to be easy to use and to introduce the range of tools and techniques in a straightforward way that means they can be picked up quickly and easily by staff who are new to horizon scanning. The nine steps in the toolkit are defined in this section.

Each step is set out in detail in Section 5 (tools for building intelligence), Section 6 (tools for creating insight) and Section 7 (tools for delivering action). As well as describing the procedure – the what, who, where and how - each step provides hints and tips to help practitioners through the process. It also indicates the output from each step and how it links to the next.

The toolkit is not prescriptive. Like any set of tools, these ones can be combined in a variety of ways to deliver various outcomes. As you become familiar with the toolkit and the processes in it, you will probably spot new or different ways to combine the existing tools and perhaps spot new tools to bring in to it.

Aim of the Toolkit

To build capability for futures thinking across the LIFE SMART partner organisations

To help regulators identify important trends and emerging issues and anticipate their potential impact on waste crime

To support multi-party discussions about these trends in order to build a common understanding of developments in waste crime

To identify priority areas for further research and action

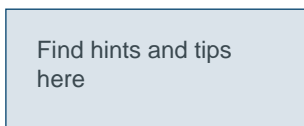
To inform development of strategic plans, operational work plans and policy development to tackle future waste crime

Using the toolkit

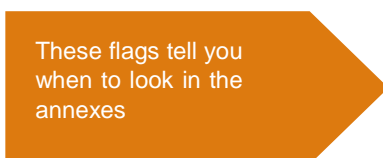
The toolkit is a practical document. As well as detailed guidance on how to use the tools, the annexes contain a range of resources to support your conversations.

- Annex 1 provides a glossary of horizon scanning terms
- Annex 2 illustrates how to use a straightforward database to organise your scans
- Annex 3 contains a sample scanning paper
- Annex 4 contains an illustrative workshop agenda
- Annex 5 sets out the methodology for scoring the scans
- Annex 6 provides sample task sheets for workshop discussions
- Annex 7 provides a sample output from a scanning workshop
- Annex 8 contains a project planning flow chart
- Annex 9 provides guidance on building a case for action

Hints and tips that will help you through the process are set out in square colour coded boxes in the relevant place.



Pointed flags indicate when you might want to look in a particular annex for more information or a particular resource.



The nine step model

The toolkit is based around a nine step approach to horizon scanning (Figure 2).



Figure 2: The nine step model

There are three steps for building intelligence about waste crime in the future:

- **Gathering intelligence** about how waste and waste crime might develop in the future
- **Organising intelligence** while you are gathering it
- **Sharing intelligence** by writing scans that draw together and highlight developments which could shape waste and waste crime in the future

There are three steps for creating insight into what the intelligence means for changing criminal behaviours and patterns of crime:

- **Assessing insights** to decide what is new and important
- **Ranking insights** to agree the emerging issues of particular strategic importance or urgency
- **Deepening insights** to determine how partner organisations should respond to the emerging issues

There are three steps for working together to research, plan and deliver action to protect consumers and the industry now and in the future:

- **Researching action** to find out more about the priority issues and to determine the scope and locus for action
- **Planning action** by working with a delivery team to make sure the intelligence from your horizon scanning work is informing the institutional response
- **Delivering action** is the stage where your organisation(s) will launch a response to issues identified in the scanning process and where you can monitor its impact

4. Managing the horizon scanning process

Introduction

The toolkit provides detailed guidance on how to run a horizon scanning process. Delivering the process requires a number of actors.

- A process manager
- Scanners
- Workshop participants
- External experts
- Project champions

None of these roles are particularly demanding of time, although the process manager will need to make some commitment to running the overall process. There is no reason why this task cannot be shared or rotated throughout a horizon scanning cycle.

You may also want one or more horizon scanning champions – a senior staff member from one or more of the partner organisations who supports the activity and speaks for it at various points throughout the horizon scanning cycle – and you may wish to set up an informal process management team, comprised of one individual from each of the partner organisations to co-ordinate communication and action across partners. There is no need for either of these roles to be overly time consuming.

The process manager

The process manager's role is to oversee the horizon scanning process and, in particular:

- To identify people to contribute as scanners, workshop participants or project champions
- To invite those people to participate as required and to brief them on the task
- To set up and organise a system for gathering and disseminating the scans
- To co-ordinate dates for scanning meetings and to book a suitable venue

- To lead scanning meetings and ensure the overall process is moving through all 9 steps
- To ensure that scanning meetings are written up and reported on
- To monitor overall progress and nudge it forwards when required

Although some of these tasks may seem administrative, the role is much more than an administrative one. The process manager is responsible for designing and driving the programme forwards and must therefore have strong connections into the partner organisations. The process management team has a key role in helping with this.

Scanners

Scanners identify the trends and developments that form the core content of the horizon scanning process. They can – and ideally should – be drawn from across the participating organisations. You can also invite people from outside the participating organisations to contribute scans if you wish.

The process manager will need to brief scanners on what is required – the **Gathering intelligence** section of the toolkit provides this briefing – and be on hand to answer any questions they might have at first.

The number of scans is perhaps more important than the number of scanners. You should aim to have around 20 scans to bring in to a workshop. They can be produced by 20 scanners each writing one scan, by one scanner writing 20 scans or by any mix in between.

Storing the scans

Scanning is a collaborative process and scanners should store their completed scans on the Hub so that they are available to other members of the scanning team and to the wider community across partner agencies.

Storing scans on the Hub also makes it easy for the process manager to monitor scanning activity and to gather scans into a scanning paper. The Sharing Intelligence section sets out how to do this.

Workshop participants

The horizon scanning workshop (section 7) is designed for between 12 and 24 participants. Participants do not need to have been involved in gathering the scans, but they do need to see them in advance so that they can read them and begin thinking about what is important (see **Assessing insights**).

You should aim for a mix of participants from across the partner organisations. You might also want to consider inviting external stakeholders to the workshops.

External experts

There may be time when you want to invite external experts – individuals with specific subject knowledge who are not necessarily stakeholders - to support research and address any evidence gaps that need to be filled to plan how to respond to emerging criminal activity (see **Researching action**).

The qualities below may help you recognise who is likely to be a suitable expert:

- Individuals that cover a broad range of expertise, mix of sectors, type of organisation and demographic.
- Individuals with international or national recognition in the field, extensive and recent publications, and recognised by a professional or trade association.
- Individuals with a demonstrable interest in the topic, and familiarity with, and commitment to, the process.

Project champions

You will have a series of future focussed project ideas once you have run the workshops. These will be developed and evaluated in the **Delivering action** stage and at this point you may wish to identify potential project champions who can take things forward.

The project champion is likely to be someone who is responsible for planning and delivering projects. (S)he may not have been involved in the early stages of your horizon scanning but will need to

become involved once you start thinking about moving projects towards implementation. Who the project champion is may depend on which partner organisation leads implementation.

The horizon scanning champion

Each partner organisation might wish to nominate a senior member of their own organisation to act as a horizon scanning champion. This individual should be someone senior who values the activity and understands its purpose. Ideally, the champion should be engaged from the outset to get partners involved and to solicit the cooperation of senior managers and executives to support the use of scanning outputs in decision-making. The process manager can provide the champion with a quarterly or six monthly briefing on how the process is going and what the outputs are.

A continuous process

Horizon scanning is a continuous process; you need to keep going around the circle. This means that, once your organisations have gathered scans and planned how to respond, you need to start gathering scans again to anticipate what is coming up next.

You will need to think about how often to run scanning workshops. Aim for one every 4 months at the start. This may be too frequent – particularly if you are following up on a number of projects – but it may not be. However many workshops you run in a year, try to ensure that some people in the organisation are scanning continuously. This way, even if you cannot hold more than one, you will still build a bank of intelligence.

Think, too, about whether individual partners want to run scanning meetings for their own organisations using the same scanning material (i.e. running meetings in parallel). This can provide important information on what different partners perceive to be important.

5. Tools for building intelligence





Gathering intelligence

| | |
|-------|---|
| What | Knowing where to look, what to look for and how to find the right information |
| Who | Anyone invited to be a scanner |
| Where | Websites, specialist journals, news articles. Google search |
| How | Be curious. Use judgment and intuition |

Takes place over several weeks

Overview

Gathering intelligence is relatively straightforward in theory but may take a little practice to get right. It is, simply, the process of looking for - and finding - interesting articles that have something useful to say about waste crime and how it might develop in the future.

Trust your intuition about what's important.

Approaching the task

There are three ways to approach the task.

The first way is to look directly in all the places you usually go to read about what's happening in waste crime. Instead of looking for news articles about what is happening now, simply look for articles that speculate about what might happen in the future or that have something to say about how waste crime is developing.

Look for emerging trends or unusual stories. Save anything that seems interesting. You can review things later.

The second way is to look at the problem from a different perspective. Focus, say, on crime rather than on waste and take a look for news articles that tell you how (any type of) crime is changing. What's interesting? Are there lessons for you? Or focus on regulation. Where are the examples of leading edge thinking and practice in regulation (it can be anywhere – it doesn't have to be crime)? Who's doing something new or interesting – or not very good?

Don't forget to look at what's happening in other countries – or in other industries.

The third way is to look for changes in the sector that creates criminal behaviour. What are the factors that cause waste crime? What are the factors that lead to these causes? What can you find about developments in those areas.

Where to look

Start with the usual trade sites and specialist journals. Google press releases from other agencies. Look at the BBC, ITN, ft.com, guardian.com and so on. Follow your nose.

Look at foreign news sites. Google policing and legislation.

Hint: It's impossible to get this step wrong

Good intelligence gathering in horizon scanning relies on both systematic analysis and insight. The latter can feel counterintuitive or unsubstantiated to those who are more practiced in evidence based strategic thinking. The hardest part at this stage is knowing whether something you have read is interesting or different enough to include in the process. Always err on the side of being 'irrelevant' – i.e. don't just include things you think are relevant, are certain about or have an interest in.

This kind of open ended search - looking for interesting information with no detailed specification about what to look for - is good for identifying new developments across the waste sector and in waste crime. It will help you develop your peripheral vision and anticipate change.

Useful questions to ask in an open ended search are:

- Is the issue interesting and new?
- What is the scale and timing of the issue?
- What does it mean for waste crime in the future?

Sometimes it's important to focus

Sometimes, you may want to be more focused; if, for example, there is an increase in a particular type of waste crime that you want to find out more about. Or if you need to focus on particular trends or issues of strategic importance at particular points of the planning cycle.

In this situation, try a more targeted search for information. If, for example, you want to know more about the main causes and potential impacts of electronic waste, use key words related to that waste stream to support the search.

Useful questions to ask in a focussed search are

- Why is the issue important for us?
- How do we think the issue is developing?
- What evidence do we have of what's causing it? What are we certain about? Uncertain about?
- How is it likely to impact on us?

On balance, your scanning activities are more likely to focus on open searches.

A long list of articles and web links that are interesting and suggest something about the future of waste crime.

When doing targeted searches, think about where you will find relevant and up to date information.

Output

A long list of articles and web links that are interesting and suggest something about the future of waste crime.

Organising intelligence

| | |
|-------|--|
| What | Gathering articles, categorising articles, prioritising what's important |
| Who | Anyone who gathers intelligence [contributors] |
| Where | In a shared online system |
| How | Organised by a process manager |

Takes place over several weeks

Overview

Once you start gathering intelligence, you need somewhere to keep it until you're ready to write the scans and put them on the Hub. You may choose to store articles locally on your own computer or on the Hub - but don't forget that you may want to invite externals to provide scans, so they need to be able to access the database of articles - or to use a curation tool such as [Pearltrees](#) or Pocket.

Looking for articles and writing about why they are interesting are different tasks. Look first then review and write about them later.

Decide how and where you want to store articles

Pearltrees is a particularly good example of a simple but dynamic system for gathering data in a way that works extremely well for a horizon scanning system. You will only be storing published articles in categorised folders at this stage, but you can set up a private account on Pearltrees if you are concerned about security.

You can also use the Hub for this stage if you prefer, but don't forget that you may want to invite externals to provide scans, so they need to be able to access the database. Organising the files by category (as Pearltrees does - see Annex 2) is a good approach to help you remember where to access them later on.

Organise and categorise articles

A good way to start is by creating folders with broad titles – such as political, economic, societal, technological, environmental, legislative and organisational. When you find an interesting article, put it into the most relevant folder.

Annex 2 shows one way you can organise articles

Build up a bank of articles and start looking for connections and themes. Don't just focus on your own articles – take a look at what others have put in the database too.

Know your sources

It's worth setting up a reference system to keep track of the various sources of your scans - news article, trade press, government report, blog and so on – and to record key words and date of publication. Review the list from time to time to see which sources are most useful and to look for updates.

Make a note of when an interesting article was published. Older articles aren't necessarily out of date, but there may have been further developments since.

Output

Articles and web links from a range of contributors collected and organised in a central repository.

Sharing intelligence

| | |
|-------|---|
| What | Writing scans, producing a scanning paper |
| Who | Contributors and the process manager |
| Where | In a shared online system and in a scanning paper |
| How | Through regular updates of the scanning paper |

Takes place over several weeks

Overview

The mechanism for sharing intelligence is the scanning paper, a document that presents a series of short scans about developments that could have an impact on waste and waste crime in the future. Each individual scan is written by the contributor who identified the issue and is based on the articles they found in the previous stages. Contributors put their completed scans on the Hub and the project manager gathers them together into the final scanning paper.

Aim for 15-20 scans per quarter.

Write the individual scans

Each individual scan should set out

- An informative and engaging title
- A description of what the scan is about
- What insights you've taken from the article(s) you've read and what they mean for waste or waste crime
- What the potential response and/or the future information requirements around the issue might be
- Links to the information sources you used in putting it together

Scans can be based on a single article or on several articles that seem linked.

Keep each scan to one A4 page. Or less.

Gather scans together into a scanning paper

Gather the scans together into a single scanning paper and circulate it to all members of the scanning team and to anyone else taking part in the insights workshop at the next stage of the process.

Annex 3 shows what a scanning paper looks like

Don't group the scans in any way. Set them out alphabetically or in the date order they were submitted. This allows participants in the next stage to look for their own connections without feeling that they are being steered towards particular scans. Do, however, number the scans. This is important for the ranking stage.

Consider sharing the scanning paper more widely

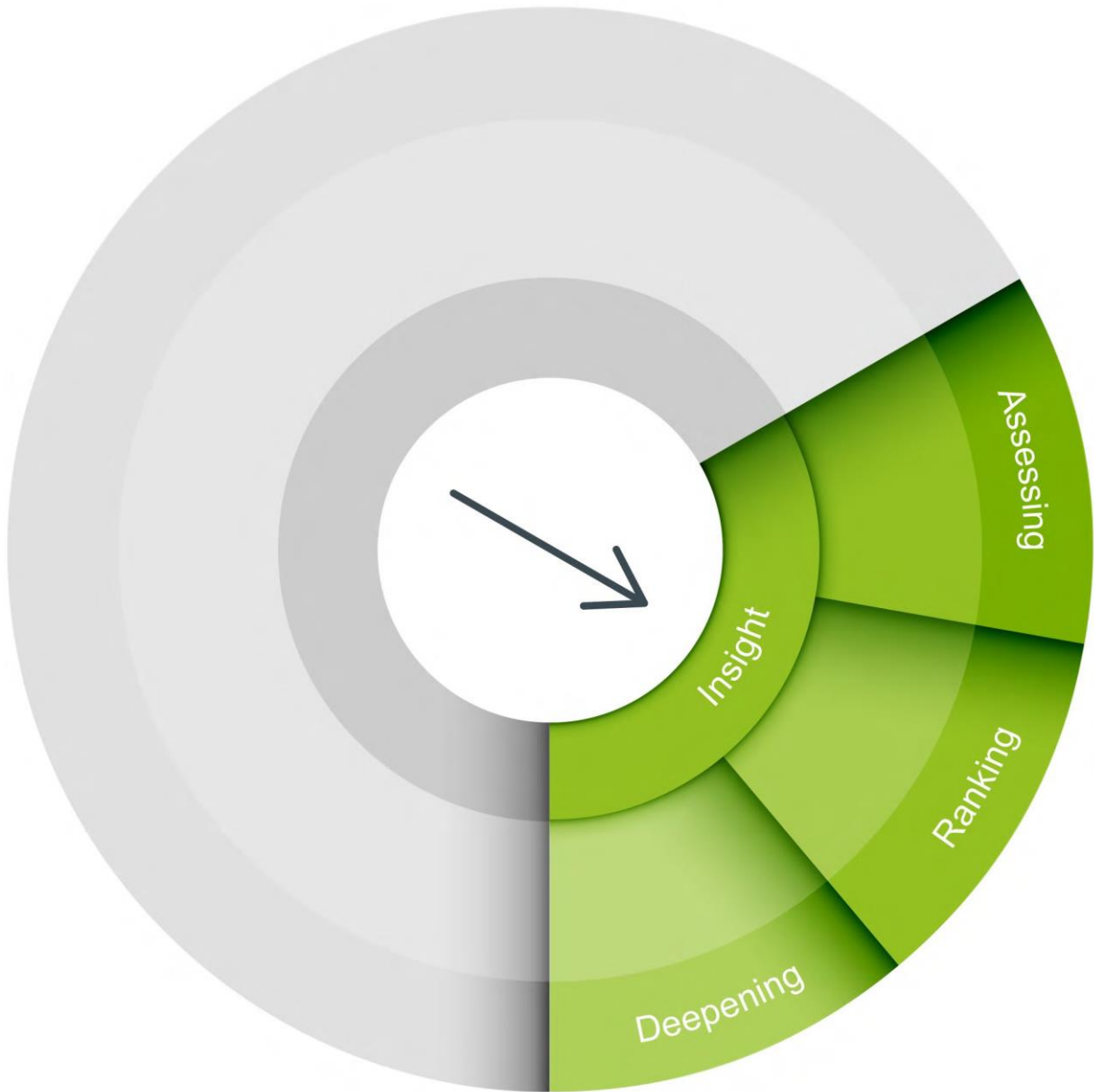
You may want to share the scanning paper with people other than the scanning team and workshop participants. Do this to get preliminary feedback on content, to make partners and key stakeholders aware of what you are doing and to highlight important emerging issues to senior managers and executives. This is a useful way to build awareness of the need to connect horizon scanning to decision making and can be a useful role for the project champion to take on.

Sharing the scanning paper will raise awareness of the horizon scanning project; but make sure recipients understand the purpose and context.

Output

A scanning paper

6. Tools for creating insight





| Assessing insights | |
|---------------------|-------------------------------------|
| What | Reviewing the scans |
| Who | Participants in a scanning workshop |
| Where | In advance of the scanning workshop |
| How | Reading and reviewing the scans |
| 10 minutes per scan | |

Overview

Assessing the insights from the scans is an individual exercise that takes place in advance of the scanning workshop. You'll receive the scanning paper – the document that sets out all the scans gathered during the building intelligence stage – in advance of the workshop and the task is straightforward: read the scans and decide what you find most interesting.

First impressions count

You don't need to spend more than 5 minutes on each scan at this point (and, in fact, you might find you spend less than that). As you read a scan, simply ask yourself if it (a) tells you something new; (b) is interesting or intriguing; and (c) feels important.

You may find that (c) is the tricky one. It is sometimes hard to explain – even to yourself - why something feels important. Don't worry if that's the case. Simply note that it does feel important.

There's no need to deliberate about each scan too much. Your first impression is what counts.

Keep an open mind

Don't reject any of the scans. Remember that they were written by your colleagues and that if something is in the scanning paper, it means that someone thought it was important enough to include. Even if the issue is one that you are aware of and that you understand well, its inclusion means that it is not familiar to everyone. Or, perhaps, that other readers can see a significant connection with other knowledge they have and that you may not have access to.

The connection between scans is often as interesting – and sometimes more interesting – than each scan on its own.

Make a few notes

If you print off the scanning document, make a few notes in the margin about why you found a particular scan interesting. Consider giving each scan a simple triage score: something like 1 (really interests me), 2 (kind of interests me) or 3 (doesn't interest me).

Think about giving each scan a score that reflects how you rate it. But remember this is mainly an aide memoire for you at this stage.

| | |
|--------|--|
| Output | Knowledge of the scans and what they could mean for the future of waste crime. |
|--------|--|



Ranking insights

| | |
|-------|--|
| What | Identifying the impact and importance of each scan |
| Who | Participants in a scanning workshop |
| Where | At the workshop |
| How | Facilitated group discussion |

90 minutes

Overview

This stage takes place in a scanning workshop. It builds on the individual assessment carried out in advance and is a group discussion where a mix of representatives from the partner organisations – together with external experts or stakeholders if possible or desirable – agree a group ranking and identify emerging issues of particular strategic importance or urgency.

Setting up the workshop

The optimal number of participants for the workshop is between 12 and 24. Invite people based on who you need to be there to validate and take ownership of the outputs. It may be that some participants have not been involved in the process before this stage, so provide an introduction that sets out the background to the project, introduces the scans and their provenance and sets out the workshop agenda and desired outputs.

Ranking the scans

The main group activity for this stage is to discuss and rank the scans according to their relative importance for the future of waste crime and the likely time horizon at which they will impact on it.

Form groups of 4 or 5 people, and work your way through as many scans as you can in the allotted time.

For each scan:

- Discuss what insight(s) about future waste crime you get from it. Take time to debate differences of opinion about what is new, interesting/intriguing, and important in the scan.
- Assign it a score that reflects the scale of the impact your group thinks it might have on the economy, on the environment and on society; and the likelihood that the specific impact will occur in the future.
- Assign a time horizon for when the impact will be seen. It's important to remember that the time horizon indicates this [i.e. when the impact will be seen] rather than when policy makers and regulators need to act. Something that creates an impact in 5 years may need action now to prevent it happening.

This stage and the next - Deepening insights - fit well together in a one day scanning workshop that runs from 10:00 to 16:00.

Annex 4 sets out an illustrative workshop agenda

Consider asking the horizon scanning champion to send the invitations.

If there is a large number of scans, the facilitator can divide them up or can ask groups to start at different points in the document (scan #1, #5, #9 and so on) and work forwards.

Remember impacts can be both risks that need to be mitigated and opportunities to be exploited.

Annex 5 sets out the detailed scoring methodology

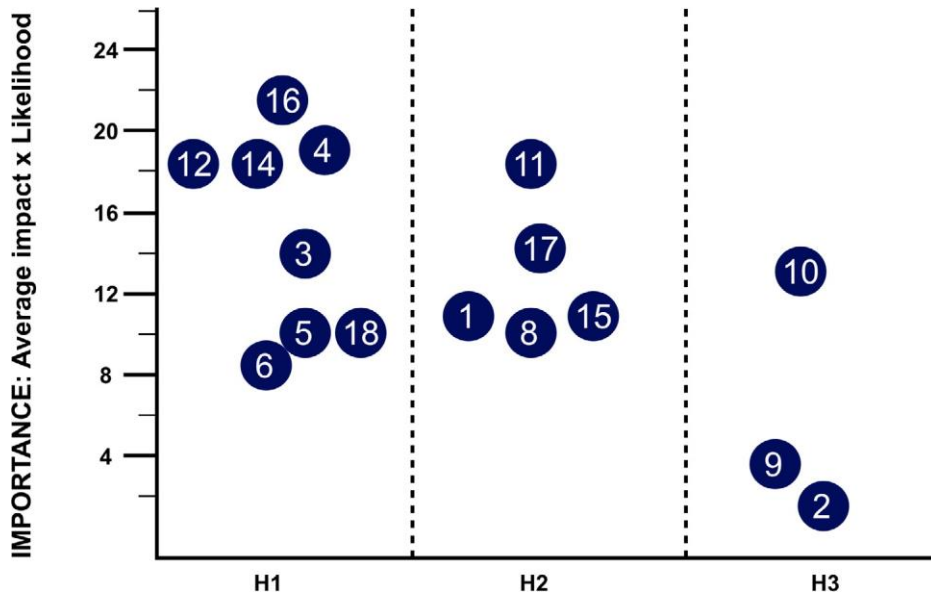
Agree the definition of the time horizon at the workshop. Time frames can be set according to your planning cycle.

Common time frames are:

- 1-2 years for horizon 1 (H1)
- 2-5 years for horizon 2 (H2)
- more than 5 years for Horizon 3 (H3)

You can adjust the timescales to meet your project needs.

The workshop facilitator should gather the individual scores and map them on the importance matrix as the groups work:



Annex 5 shows how to create the importance matrix

Review the map

At the end of the conversation, review the importance matrix in plenary and discuss the group's thoughts about links and relationships between the different scans.

Output An agreed map that ranks the scans according to their importance and that identifies relationships between them.



Deepening insights

| | |
|-------|--------------------------------------|
| What | Identifying risks and evidence needs |
| Who | Participants in a scanning workshop |
| Where | At the workshop |
| How | Facilitated group discussion |

75 - 90 minutes

Overview

Now that you have mapped the scans and ranked the insights, the next step is to develop a shared understanding of why you have given some insights a high score and what that means for how you and your partner organisations should respond to the issues. You can work in the same groups of 4 or 5 (Ranking insights) or form smaller groups of 3 or 4 for this stage.

You can form the groups randomly – but make sure there is a mix of partner organisations in each.

Agree what to discuss

You may not have time to discuss all the issues or clusters that you prioritised in the **Ranking insights** stage, so spend a moment or two before you start deciding which ones you want to focus on. You don't have to focus only on the ones that got the highest score. If your group feels that an issue with a lower score demands your attention, go ahead and include it in your discussion.

Tell the other groups which insights you are working on – to avoid duplication!

Characterise the risk/opportunity

At this point, you know that the issue/cluster you have chosen to explore further is important; in this step, you articulate why. Now discuss the following questions and record your conversation on the **Deepening insights task sheet**:

- What risk or opportunity does the issue pose to the economy, the environment and [or] society?
- How might the risk or opportunity manifest between now and the identified time horizon?
- What needs to be done to mitigate the risk or exploit the opportunity?
- What evidence gaps do you need to fill - what do you need to know or track to ensure the response is effective?
- Who needs to be involved in taking this issue forwards?

Annex 6 has sample task sheets

If you want to speed up the recording and reporting process, use laptops to fill in the task sheets.

Keep talking

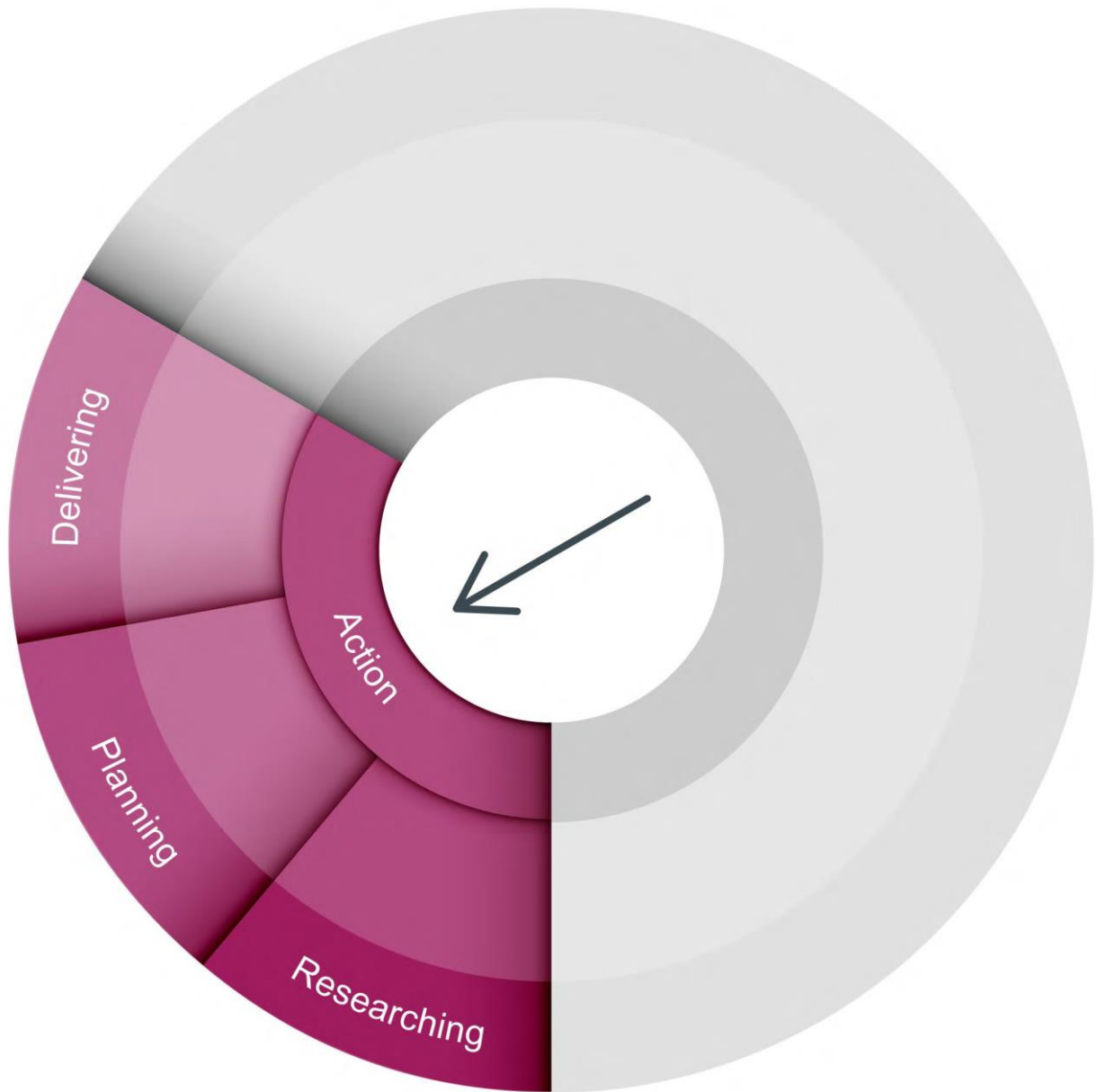
You probably need about 30-40 minutes to discuss each issue (although you'll find you get faster with practice). So, once you've completed the conversation for one cluster or group of ideas, pick another one and try again. If you have four breakout groups and each one discusses 2 issues/clusters, you'll make a lot of progress.

Annex 7 has an sample output from this conversation

Output

A long list of issues that you have identified as priorities and that will feed into the next stage to be researched further and, perhaps, to be acted upon.

7. Tools for delivering action



Researching action

| | |
|--------------|--|
| What | Review and research evidence gaps. Develop a short list of areas for action. |
| Who | Research team |
| Where | Individual desk based |
| How | Group discussion and individual research |
| Several days | |

Overview

This activity follows on from **Deepening insights**. It is carried out by a research team who review the output from the workshop and conduct desk-based research to (a) find out more about the priority issues and to (b) determine the scope and locus for action.

Allocate the task to a research team

The research team might be a dedicated unit that looks at all the output from the scanning workshop; or it might be workshop participants who decide to do the research themselves. Most issues will be important to more than one organisation, so try to ensure the team has members from all relevant partners.

Review the risk and the evidence gaps

The main task is to review the long list of issues that were identified as priorities in the workshop stage to make sure they are real challenges that need to be tackled. This is partly due diligence and partly about beginning to shape the partnership's response.

Workshop discussions are usually accurate but not always comprehensive – so review each issue to confirm the nature of the risk/opportunity, the timescale and what needs to be done to manage it.

You may then want to triage issues according to those that need an immediate response – these move forwards to the planning action stage and become projects - those that need further research, and those that can be dropped.

Gather expert and wider stakeholder input

Build the evidence base by exploring specialist literature or by conducting a more focused scan based on specific keywords that came out of the workshop conversation.

Think about subject experts inside and outside your organisations and contact them to see if they are aware of the issue.

Think, too, at this stage about how you intend to take these ideas to the relevant decision makers in the partner organisations and consider briefing the horizon scanning champion on progress.

The review should clarify the evidence and its limitations.

Identify a team leader to oversee the research. This person may become the project champion if the project moves ahead.

Sometimes an evidence gap exists because there is no research or data; and sometimes it exists because there is data but no-one knows where to find it.

Begin with the more important issues – but remember that some less important ones may become more important once you look at them more closely.

Output

A triaged list of issues. Some issues passed on to the next stage for detailed implementation; some issues researched in greater detail; and some issues dropped from the process.

Planning action

| | |
|-------------|---|
| What | Support the delivery team and plan the response |
| Who | Delivery team assisted by research team |
| Where | Project planning meetings |
| How | Secure decision to go |
| As required | |

Overview

Once you've identified an emerging issue and the partnership has decided to respond, it's important that you work alongside the delivery team during the planning stage to make sure the intelligence from your horizon scanning work is informing the design of that response.

Make the case for action

It's worth remembering at this stage that, no matter how important or obvious the issues now seem to you, the planning team will still need to be fully briefed and even, perhaps, convinced that the insights from the scanning work should be followed through.

Think about the best way to achieve this. Use the **Researching action** stage to build your case and engage the delivery team as early as possible. Spend time with them to make sure you understand the operational issues they are facing and they understand the relevance of the scanning evidence you have gathered.

Talk to those with experience

By this stage, you may be looking at practice that has been developed elsewhere. You may be thinking about how to adopt practices from other parts of the world that have been successful in tackling waste crime; or you may be looking at novel regulatory practices in other industries that you want to introduce into the waste crime arena.

In either case, consider how to introduce members of the implementation team to these practitioners and how to facilitate a conversation about process and skills transfer.

Work alongside the delivery team

Whatever approach you take, keep working with the delivery team. Work alongside them to develop a project plan, using the internal procedures or drawing on the project planning flow chart in Annex 8. Learn from them about what they find easy and what they find difficult. A 'deep-dive' project may help to develop a rationale for action, or help them to see the benefits of new ways forwards. Make sure that your suggestions are both practical and implementable.

Deploy the horizon scanning champion to secure high level engagement with the issues.

Don't assume that everyone will immediately see the need to act. Or see how to act.

Skype. Visit. Host.

Annex 8 has a project planning flow chart

Annex 9 illustrates the scope of typical deep-dive projects

Output

An action plan.



Delivering action

| | |
|-------|------------------|
| What | Implementation |
| Who | Delivery team |
| Where | In agency |
| How | Through projects |

No fixed time

Overview

This is the stage where your organisation(s) will launch a response to issues identified in the scanning process. By this time, you will be less involved, but you should keep a watching brief on the project to monitor its impact and to learn how to make future intelligence gathering relevant to the organisation.

Monitor the organisation's – and the scanning process's - performance

The measure of success is not that the organisation has picked up and developed a response to an issue identified during the horizon scanning process – although that is certainly a positive outcome – but that the response makes a difference to the management of waste crime and criminal behaviour.

Keep close to the project to track whether it is making that difference. You may not be able to evaluate the project formally, but try to speak to the operational team to find out what went as expected and what didn't. Find out, too, if they believe any information from the scanning process could have been more informative or more specifically targeted.

Review the impact on waste crime and criminal behaviour.

Use the learning to review the horizon scanning process

By this stage you may find that a number of issues you identified in the horizon scanning workshop(s) have not fed through to an operational response. There may be a number of reasons for this: timing, resources, quicker movement in the marketplace than the organisation(s) expected, or changes in criminal behaviour. This is quite standard in horizon scanning processes.

Feed the learning from experience back into process design.

Use this time to reflect on what worked well and what didn't and to adjust the overall process accordingly.

Output

Design lessons for further rounds of horizon scanning.

| | |
|---|-----------|
| 1: Glossary of horizon scanning terms | 27 |
| 2: Using Pearlrees to organise your scans | 29 |
| 3: Sample scanning paper | 30 |
| 1. Data-driven governance | 30 |
| 2. Innovation in public service delivery | 31 |
| 3. Anticipating criminal behaviour | 31 |
| 4. Who cares? The role of popular media | 32 |
| 5. Regulatory reform | 32 |
| 6. Smart citizens control their own data | 33 |
| 7. The age of Thatcher’s grandchildren | 33 |
| 8. ‘Smart contracts’ to legitimise financial transactions | 34 |
| 9. New tools to build trust | 34 |
| 10. Smart tyres | 35 |
| 11. Oceans of data..... | 35 |
| 12. Betting on the data | 36 |
| 13. There’s an app for that..... | 36 |
| 14. Hotspot analysis: pinpointing actors in the supply chain causing the biggest problems . . | 37 |
| 15. ‘Localised’ circular economy solutions | 37 |
| 16. New legislation to tackle waste smugglers | 38 |
| 17. Open vs closed access predictive policing | 38 |
| 18. Insurance industry launches risk and compliance support..... | 39 |
| 19. UK risks becoming dumping ground for plastic after Brexit..... | 39 |
| 20. Call for EA to hold the government to account post Brexit | 40 |
| 4: Sample Ranking Insights workshop agenda | 41 |
| Aims | 41 |
| Agenda | 41 |
| 5: Methodology for scoring the scans | 42 |
| Scoring the scans | 42 |
| Mapping the scans..... | 43 |
| Annex 6: Sample workshop task sheets | 44 |
| Ranking Insights Task Sheet | 44 |
| Assign each scan an importance score..... | 45 |
| Deepening Insights Task Sheet | 46 |
| Annex 7: Sample output from a scanning workshop exercise | 49 |
| Annex 8: Project planning flow chart | 51 |
| Annex 9: Building a case for action | 52 |
| Annex 10: About the authors | 53 |

Annex 1: Glossary of horizon scanning terms

| | |
|----------------------------|---|
| Article: | a story or report in a newspaper or magazine or on the web that provides some information – either directly or indirectly – about the future of waste crime. |
| Contributor: | someone involved in any aspect of the horizon scanning process. |
| Critical uncertainty: | a driver that is important for the future of waste crime but which has an uncertain outcome. |
| Driver (of change): | a current or emerging trend that is likely to shape (have an impact on) the future development of waste crime. Drivers are typically categorised as Political, Economic, Societal, Technological, Environmental, Legislative or Organisational. See PESTELO. |
| Facilitator(s): | the individual(s) who are responsible for designing, managing and delivering horizon scanning workshops. |
| Focused search | a focused search is a particular approach to scanning where the scanner uses key words to search for articles about a specific topic, trend or issue of strategic importance. There is usually some specification about what to look for. |
| Horizon scanning: | the process of looking for early warning signs of change in the policy and strategy environment. |
| Horizon scanning champion: | a senior staff member from one or more of the partner organisations who supports horizon scanning and speaks for it at various management meetings. (S)he should value the activity and understand its purpose. |
| Intuition: | the belief that something is going to be strategically important in the future, even when there is insufficient evidence to prove that it will be. |
| Online database: | a system for storing, organising and sharing articles that members of the scanning team have found. |
| Open ended search: | an open ended search is a particular approach to scanning where the scanner simply looks for articles and stories that (s)he finds interesting. There is no detailed specification about what to look for. |
| Process manager: | The person (or people) who oversee the horizon scanning process and who are responsible for designing and driving the programme forwards. |
| Project champion: | someone who is responsible for planning and delivering projects that emerge from the horizon scanning process. |
| PESTELO: | an acronym which stands for Political, Economic, Societal, Technological, Environmental, Legislative and Organisational drivers. There are a number of common variants which describe the same drivers or a subset of them – PEST, STEP, STEEP, STEEPL, PESTLE. |

Scan: (noun) a short note that describes an external event or emerging trend pointing towards change in the sector.

(verb) to look for articles that describe external events or emerging trends that suggest change in the sector.

Scanner: an individual who scans, usually as part of a structured process.

Scanning paper: a collection of individual scans, probably gathered from a number of scanners.

Stakeholder: any group or individual who has an interest in or an influence on the future of waste crime and how it is tackled.

Targeted search: A search for information that is focused on a particular type of waste crime that the scanning team wants to find out more about. May be linked to the planning cycle.

Trend: a visible – or emerging – pattern of events that suggest change. A ‘trend’ becomes a ‘driver’ when it acts directly on waste crime.

Annex 2: Using Pearltrees to organise your scans

[Pearltrees](#) is a good example of a simple but dynamic system for organising data in a way that works extremely well for a horizon scanning system.

Setting up Pearltrees

Set up a [Pearltrees](#) account online.

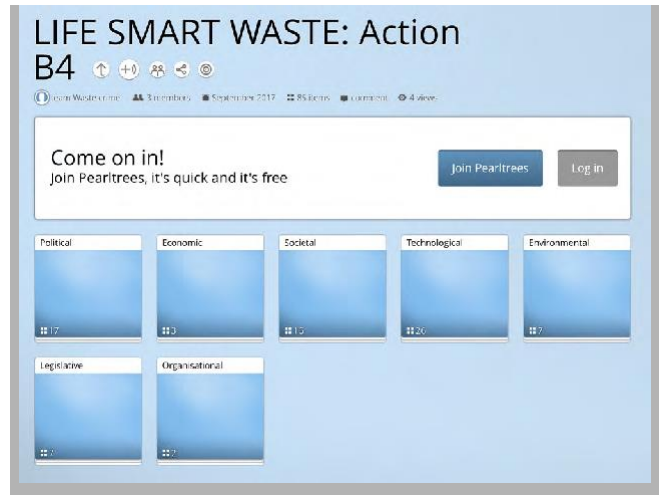
You can set up a free public account with 1 GB of space; but free accounts are visible to the public. If you want to keep the scans confidential, you can invest in a premium private account for a nominal annual fee.

The system is intuitive and straightforward to use. This [Youtube video](#) provides a clear demonstration and there's a good [FAQ](#) section that provides additional information.

You may prefer to use the Hub for this stage of the process as well as for storing the final scans; in which case it may be useful to model the structure and process on the Pearltrees approach.

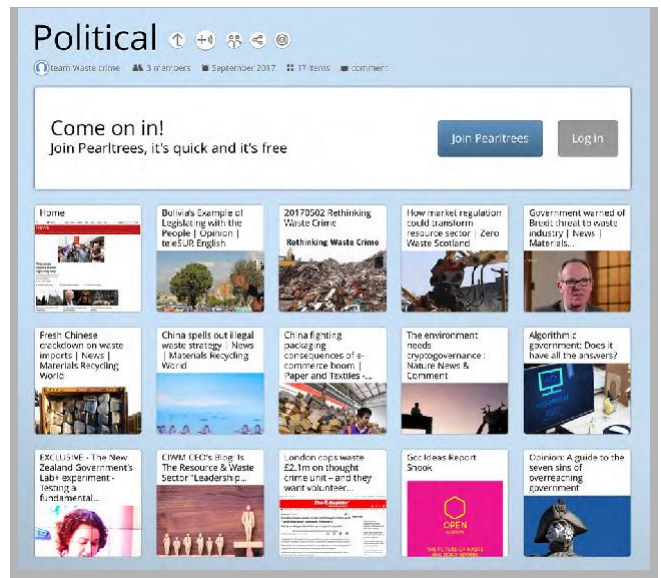
Storing and categorising articles

Set up a series of folders that represent the PESTELO framework...



LIFE SMART Waste [Pearltree database](#)

And add documents to the relevant folder as you find it...



LIFE SMART Waste [Political database](#)

You can drag and drop files, use the 'Add' button with the application and can use the Pearltrees web clipper to select articles while you browse.

Annex 3: Sample scanning paper

This Annex contains a number of scans that Cranfield produced for LIFE SMART Waste during project development.

The scans are numbered as an aid to the workshops discussion that takes place during the **insights** stage of the process.

1. Data-driven governance

There is [a new trend of data-led judgements](#), with the criminal system relying on data to determine the optimum prison sentence and parole conditions for criminals.

Similarly, a local authority in England (Milton Keynes Council), as part of its transformation into a smart city, is installing [sensors to gather operational data in order to send rubbish collections along optimum routes](#) (i.e. waste bins with sensors send alerts when they are full). Citymapper, working with Transport for London, is trialling a new bus service in Central London that will use [data from smart phones to identify better routes that 'react to real-time needs'](#).

What this might mean for waste crime

The use of technology and big data is changing the culture of decision making in governments, but [there are issues around the lack of transparency about how algorithms work, particularly when this data is used as the basis for prosecuting crime.](#)

How might LIFE SMART Waste partners harness information and knowledge from sensor data and unstructured digital channels (e.g. social media, smart phone applications) to characterise risk factors and trace development pathways of waste crime?

How might LIFE SMART Waste partners embed this data to produce relevant, timely information and knowledge needed for their effective use in both strategic and operational contexts?

2. Innovation in public service delivery

Nesta is working with leading innovators around the world to determine [how innovation approaches can be useful and what skills and competencies are needed to enhance problem solving in an administrative and political context](#). They set out crucial skills that are necessary for successful experimental problem solving:

- **Accelerating learning:** Exploring and experimenting to identify knowledge gaps, create new understanding and inform decision-making in new ways
- **Working together:** Engaging with multiple stakeholders to ensure co-creation and collaborative ownership of new solutions
- **Leading change:** Creating space for innovation and driving change to mobilise people, inspire action and ensure strategic outcomes

The New Zealand government is trialling an 'innovative lab' that is providing a mechanism to bring together design, technology, information management and agile development for more rapid and targeted service design and delivery. At the pilot stage, [the lab involves highly skilled public servants from several agencies as well as private sector companies](#) across different disciplines, including: design and technology, information, policy and data science. The lab establishes a collaborative space, additional expertise and tools for service delivery teams to work differently (i.e. co-design and implement services).

What this might mean for waste crime

Critics of innovation frameworks suggest a better approach is [the use of social and digital platforms to source ideas from within and beyond the organisation](#).

What will strengthen the innovation capacity of LIFE SMART Waste organisations and teams to enable a better use of innovation resources in order to deal more effectively with waste crime?

3. Anticipating criminal behaviour

[Proactive policing](#) is used extensively in (for example) traffic management, where traffic cameras and Automatic Number Plate Readers (ANPR) identify criminal behaviour. Data analysis means these technologies also support wider crime investigation. Following a recent series of armed robberies in three different cities, [police used ANPR to review all 40,000 vehicles travelling through each location](#) on each of the days. Two vehicles were found to have been in all three locations. Mobile phones in the vehicles were used to identify four suspects who were then arrested.

Predictive policing uses predictive analytics to tie crimes to people or places. The techniques are moving beyond existing approaches such as [CCTV-based pattern analysis and surveillance algorithms that forecast where crimes are likely to occur and who might commit them](#); and that then make recommendations for allocating police resources. Responses are granular and directed. Patrols are sent to a specific city block rather than to a whole neighbourhood and crime data are added daily to generate predictions for each shift.

What this might mean for waste crime

The emerging technology is creating both [excitement at its potential for crime fighting](#) and [concern over civil liberties](#). There are a number of issues that need to be managed – such as independent evaluation, training algorithms and biased crime data – and crime fighting agencies will need to be more strategic in how they deploy predictive modelling and work with government and the public to build.

How might LIFE SMART Waste partners use machine learning to anticipate waste crime? Is there scope to pilot the approach with a third party provider? Can [recent attempts to predict crime in London](#) be applied to cities in Scotland? And will the imminent launch of smartphone apps such as [Incident Desk](#) make a real difference?

4. Who cares? The role of popular media

Placebo, an alternative rock band from the UK has released [a short film](#) shot in the enormous electronic waste dump in Agbogbloshie, a former wetland in the heart of Accra, Ghana. It is a striking film of a striking environment, offering a glimpse of the lives of people who live on the dump.

The band put out a brief for the music video around e-waste and singer Brian Molko is keen to stress that the video is not anti technology but does [want to raise awareness](#) about the repercussions of just throwing away tech that doesn't work anymore. "There are several new and ingenious ways to recycle tech these days," Molko says. "Some companies will even give you money for it. All it takes is a little more effort."

What this might mean for waste crime

Bands have a [long standing tradition of standing up for causes](#) of one sort or another. Placebo's film is indeed striking and their message is important.

Could waste crime be a sexy and exciting topic for this channel of communication? Why not? The message may need to be crafted, but waste crime is a form of social and environmental injustice and using new channels to reach new audiences with important messages is worth trying.

5. Regulatory reform

[A new utility sector, 'OfWaste', could regulate the market place](#) and drive investment in the resources 'grid', similar to the electricity or water grid, where the management and supply of resources has been controlled within an established and consistent framework (e.g. Ofwat, Ofgem, Ofcom). Such regulation of the market place could give confidence to legitimate operators, through greater transparency in pricing and a consistent standard of performance that all operators would have to achieve. This system could also support enforcement of, for example, compulsory use of Electronic Duty of Care, and help exclude illegal operators.

[Changes to regulations in England are needed to modernise a dated waste management system](#); these include improving the regulatory regime and

enforcement efforts, developing secure sources of funding, and increasing cross-regulatory cooperation and raising awareness.

Examples of some of the changes recommended are:

- Closing the gaps in regulation
- Reducing exemptions for waste sites
- Setting new standards to qualify as a waste carrier, broker and dealer
- Stronger enforcement of failures in Duty of Care right through the waste chain
- Improving enforcement efforts by introducing a new inspection regime for sites
- Developing an electronic waste transfer note system for better traceability
- Improving cross-regulatory cooperation and raising awareness

[Crowdsourcing as an approach to reform constitutions](#)

are being trialled in some European countries (e.g. Iceland and Finland) on issues such as off-road traffic laws and to identify the fundamental values and principles people want to see enshrined in law/ the constitution (e.g. human rights, equal access to healthcare).

What this might mean for waste crime

Introducing [consistent standards of performance for all waste operators](#) could go a long way in protecting the interest of legitimate operators and those of their customers, but [a more risk-based approach may be needed for operators that handle small volumes of waste](#) that potentially pose lower environmental risks.

[Tightened regulations](#) could address the potential rewards generated by waste crimes, alongside the systematic failure in the way the sector operates which makes the risk of detecting crime low. However, such reforms need to consider the [uncertainties around Brexit](#) that could introduce new rewards and opportunity for waste crime if 'restrictions, or imposition of tariffs, on the UK's trade with the EU in recycling and waste significantly increase the costs of waste management'. [New traditions are being established for constitutional reforms](#); post-Brexit waste policy could be crowdsourced with new laws being debated with those sectors that would be most directly affected by them.

6. Smart citizens control their own data

Most visions of the smart city put government or corporations in charge of the technology and infrastructure. [Critics worry](#) that cities may get too smart, "reducing people to data-points...surrounded by more and more circles of service that create bubbles of control."

A number of initiatives are focussing on how citizens can take more control, gathering data and using it to reshape the urban environment to meet their needs. Detroit's [Sensors in a Shoebox](#) project, for example, puts sensors in the hands of local teenagers to engage them in identifying problems in their community and working on solutions. Edmonton's [BetaCity](#) project uses wifi connected sensors to gather data and inform citizens about the quality of the urban environment.

[Smart Citizen](#), an independent environmental monitoring network is now [live in Manchester](#). The Smart Citizen Kit gathers data about CO, NO2, temperature and noise and streams data over WiFi to the Smart Citizen network. As the project evolves, Smart Citizen plans to extend community engagement into new areas.

What this might mean for waste crime

New areas...such as waste crime? One thing these citizen based projects have in common is that they are in the early stages of development. Another is that they have ambition. There is scope to engage in partnership to develop communities' thinking.

One of the key partners in Smart Citizen is the University of Dundee, who's [Centre for Environmental Change and Human Resilience](#) seeks to empower citizens through environmental monitoring. Worth a call...?

7. The age of Thatcher's grandchildren

British [young people are more right-wing and authoritarian](#) in their views than preceding generations, according to research based on the [British Social Attitudes Survey](#). The findings contradict the popular view that younger people generally tend to be more progressive.

A paper published in the [British Journal of Political Science](#) found that the generation growing up in the period of Conservative rule starting with Margaret Thatcher — aged 41 to 58 today — hold more right-wing values than their predecessors. But "Blair's babies" — those aged 27-40, who came of age while Tony Blair and New Labour were in power in the late 1990s and 2000s — are even further to the right of the political spectrum, the research team found.

Although younger people are more socially liberal on matters of equality and women's rights than preceding generations, they are "more consumerist and individualistic" on issues such as the welfare state. They are increasingly negative in their attitudes to the benefits system, the unemployed, benefit recipients and the welfare system; and they take a harder line on crime than previous generations.

What this might mean for waste crime

Age appears to be the [new dividing line in UK politics](#) and across [UK society](#). Social mobility tsar Alan Milburn says that "Young people increasingly feel like they are on the wrong side of a profound unfairness in British society - and they are unhappy about it." And Sir Peter Lampl, chair of the Sutton Trust which promotes social mobility, said "Political rhetoric needs to be translated into real policies to level the playing field and improve opportunities for young people."

Legislation that matters to young people – such as environmental protection, maybe – needs to reach out to young people. And maybe, younger people – surprisingly? - want to see tougher decision making and want to see criminality stamped out.

8. 'Smart contracts' to legitimise financial transactions

Bitcoin, an open-source virtual currency, triggered by the 2008 financial meltdown, uses [a digital protocol that relies on cryptography \(the blockchain\) to trade without a central authority that may be vulnerable to corruption](#). No central authority controls the blockchain — its operation is distributed across many computer platforms around the world. Blockchain technology can guarantee that a planned event will happen. For instance, an invoice will be automatically paid when a shipment arrives. This is done by drawing up 'smart contracts' that represent business logic written in computer code. That code is implemented on the blockchain using a programming extension called Ethereum. Smart contracts are executed when particular conditions are met.

What this might mean for waste crime

'Up front' financial transactions between waste producers and service providers account for the whole life cost of waste, creating opportunities for illegal activity (e.g. default on obligations). [Bitcoin transactions establish 'smart contracts' that may lead to a more reliable \(secure and auditable\) financial system](#), reducing the burden on regulators.

The blockchain [increases transparency in global supply chains by eliminating a vulnerable paper chain](#). It offers a digital footprint for each container and can reduce access to limit the risk of criminals identifying and targeting containers. However, the [financial stability \(profitability\) of institutions \(banks\) that support transactions would be challenged by the blockchain](#). There are additional concerns about the ability of institutions to cope with the digital innovation of a blockchain transactional system; all of which questions its feasibility.

9. New tools to build trust

[Trust - the Nordic gold](#), published by the Nordic Council on 16 June 2017 explores why Nordic countries are doing so well in the [World Happiness Report 2017](#). "The Nordic countries understand that trust is a currency that can have enormous economic, political and social benefits," says [Rachel Botsman](#) of the University of Oxford. "[There are] links between high levels of social trust and the benefits people experience in the region, from individual happiness to lower crime and long-term unemployment."

Society has historically put its trust into institutions, authorities, legal contracts, regulation and insurance - but this is changing as society realises that institutional trust wasn't designed for the digital age. Public trust in institutions, political parties and the media is beginning to crumble. [Bo Rothstein](#), also at the University of Oxford, explains what is at risk if social trust declines: "The individual finds it less meaningful to pay tax, use the social insurance systems appropriately, sort their waste, respect laws, and not accept corruption."

Botsman and Rothstein argue that institutions and systems - health, political, financial and others - need to be redesigned to become more transparent, inclusive, personalised and accountable.

The Nordic countries are no exception and are concerned that increased economic differences, immigration and political polarization mean that individuals will be less inclined to contribute to society if public institutions don't remodel trust.

What this might mean for waste crime

This may feel like a long term issue but it (a) seems very important for the present and (b) can be addressed by institutions beginning to work together now to explore how trust is changing and what it means for collaborative regulation.

10. Smart tyres

Michelin launched [a new generation of truck tyres](#) at the 2017 Commercial Vehicle Show in the UK and Ireland. Amongst other improvements, the new X Multi tyre line-up includes an integrated RFID chip that makes the “connected tyres” open to several digital services - including traceability of operations.

Cambridge Consultants, a product design firm, believes that its [Pizzicato technology](#) will allow it to produce ‘smart dust’ – cheap (6 pence) radio transmitters that can be shrunk dramatically and embedded in materials and used as sensors to detect changing conditions or location of objects. The company’s proprietary algorithm allows standard digital technology to generate high-frequency radio signals in real time and to detect at a distance.

What this might mean for waste crime

These two technologies might combine and develop. The Internet of Things (IoT) - the network comprised of physical objects with embedded electronics, sensors and connectivity that collects and exchanges data – may have a role to play in capturing and analysing data from smart tyres and smart dust to improve traceability and track provenance.

11. Oceans of data

Environmentalists are using satellites to track fishing vessels across the world’s oceans, alerting authorities when boats appear to violate protected marine areas. They are now opening their system to the public with an online mapping tool called [Global Fishing Watch](#) and are inviting anyone who can to put eyes on rogue fishers.

The tool is a collaboration between [SkyTruth](#), Google and [Oceana](#) and is based on an [algorithm](#) that uses the speed, headings and other aspects of a ship’s motion to identify whether it is fishing or not. Vessels thought to be fishing are cross-referenced to registries that reveal their size, ownership and country of origin. Global Fishing Watch [uses Google Earth Engine](#) to display this information on an interactive map, which also shows the boundaries of marine protected areas and the exclusive economic zones around nations’ coasts.

Global Fishing Watch plans to add features that will [allow users to select regions of interest](#), such as a particular section of coastline, and receive automated alerts when fishing activity is detected there. They are also going to build a feature so that users can create a fleet themselves by selecting particular ships. “An insurance company might be interested in monitoring just those vessels it insures,” says Jacqueline Savitz, vice president for U.S. Oceans at Oceana. “Others might want to keep tabs on ships that have been placed on blacklists because of previous regulatory violations.”

What this might mean for waste crime

This illustrates the emerging trend of using remote surveillance technologies to combat polluters and the illegal exploitation of natural resources. And it’s not only at sea. Google previously joined forces with the World Resources Institute to create the [Global Forest Watch](#) system for monitoring illegal logging. Google is also using methane sensors on its street view cars [to map natural gas leaks](#) in cities such as Boston and Dallas.

12. Betting on the data

The London Borough of Barking & Dagenham has used [recent findings from its data science team](#) to model how local betting shops can influence gambling addiction. Speaking at Nesta's [City Data Analytics](#) event – designed to showcase UK regions that are working to join up, analyse and act upon data at a city or regional scale to reform public services – the borough's [Insight Hub manager Pye Nyunt](#).

The model uses a range of data - demographics, the proximity of schools and colleges to betting shops, local mental health problems, the presence of homeless shelters, food banks and payday loan shops – and tree based models to come up with the spatial indices, z-scores to normalise the data, and kernel density estimations to approximate how many vulnerable people live close to the betting shops.

The team expected gambling addiction to be scattered across Barking & Dagenham, but found it to be concentrated in three wards. It also established that the shops were clustered together to attract gamblers who had exhausted their credit for fixed odd betting terminals in one to go to another.

In addition to using the evidence in its own gambling licensing policy, Nyunt believes it could influence future legislation.

What this might mean for waste crime

What's interesting about this story is how local it is and how a London borough has carried out such sophisticated analysis.

It's also interesting that the results were unexpected and that the correlation between behaviour and geography was - with hindsight and the right information – surprisingly obvious.

13. There's an app for that

The Vigilante app was launched on the Apple store in November 2016. Vigilante was designed to inform New York City residents of nearby crimes in progress reported to the police, allowing users to avoid the area. Or, if they preferred, to go along and video the action. New York City police were unimpressed. So was Apple, which [removed the Vigilante app](#) from its store days after its launch.

But you can't keep a good app down and Vigilante is [back in the app store](#), this time called [Citizen](#).

There's [considerable unease](#) about Citizen. While it now offers “strong guidance” to “never approach a crime scene, interfere with an incident, or get in the way of police,” it does allow users to see incidents as red dots on a map, which is something that could make it a tool for avoiding particular areas. Citizen's premise is that all crimes threatening public safety should be aggregated and streamed, consequences be damned, because this is how crime will be reduced.

What this might mean for waste crime

These two technologies might combine and develop. The Internet of Things (IoT) - the network comprised of physical objects with embedded electronics, sensors and connectivity that collects and exchanges data – may have a role to play in capturing and analysing data from smart tyres and smart dust to improve traceability and track provenance.

14. Hotspot analysis: pinpointing actors in the supply chain causing the biggest problems

[Tools for dynamic visualising and mapping in a GIS environment](#) have provided crime analysts with different ways of visualising and mapping crime, including to:

- inductively describe and visualise spatial distributions
- identify unusual observations or spatial outliers
- discover patterns of spatial association, including clusters or hot spots

Recently, Greenpeace researchers analysed forest fire hotspots recorded in Indonesia and concluded that nearly [40 percent of fires occurred inside mapped concessions: land granted by the Indonesian government to companies for logging or plantation development](#).

What this might mean for waste crime

Can advances in tools for the analysis of ‘hotspots’ determine which ‘type of actors’ in the supply chain, whether engaged in ‘permitted or unpermitted’ activities, are causing the biggest problems?

To be helpful, [this data will have to be broken down to reflect ‘meaningful results’](#) that can lead to the deployment of appropriate resources to address the issues. For more meaningful results, the data should reflect:

- individual types of crime (i.e. crime type distribution)
- time intervals (no. of incidents occurring within a given period) that reflect temporal dependencies
- physical and social barriers between places

15. ‘Localised’ circular economy solutions

Architects have developed ‘futuristic ideas’ for waste disposal, where people coexist with their waste as a resource and benefit from it. Taking inspiration from waste management systems in New York, they have proposed numerous solutions including the use of the city’s transport infrastructure, buildings and local people to transfer and process organic waste, using the [compost to create green space and community farms on rooftops](#).

Similarly, Solar CITIES (Connecting Community Catalysts Integrating Technologies for Industrial Ecology Solutions), an NGO, is supporting families and businesses to build [solar biodigesters themselves to produce clean fuel and fertilizer from green waste](#).

What this might mean for waste crime

Circular economy business models have the potential to establish secondary markets by continually cycling materials back through supply chains. While this may reduce market opportunities for illegal operators, the challenge is understanding how illegal markets behave (i.e. emerges, operates and is sustained) and how to tackle criminal behaviour.

16. New legislation to tackle waste smugglers

China has launched a one-year campaign, [National Sword 2017](#), to tackle waste smugglers. The legislation specifically targets 'foreign waste' as well as agricultural products, resource products, tax-related good, drugs, guns and other illegal smuggling activities. The Chinese Government is seeking to strengthen its co-operation with a number of responsible organisations to coordinate implementation and enforcements of laws.

This cooperative approach has led to a [major crackdown on organised criminal gangs involved in the smuggling of solid waste](#). For example, a team consisting of 172 officers from customs, environmental protection, inspection and quarantine, and industry and commerce, raided 16 warehouses in the city of Guangdong and recovered smuggled plastics and metals to value of RMB 1billion (£115m).

What this might mean for waste crime

The [European Commission](#) has stated that fighting environmental (including waste) crime requires:

- a comprehensive multidisciplinary approach at all levels
- better cooperation and exchange of information between the competent authorities and with third countries
- enhanced dialogue and cooperation with relevant international organisations

Greater cooperation among responsible organisations and tighter regulations advocated internationally raises questions about how this would work in practice, and be sustained in the long-term given resource constraints on regulatory bodies.

17. Open vs closed access predictive policing

Predictive analysis has been used traditionally in policing to understand and anticipate criminal activity, but there is growing interest in the [use of open-sourced software in predictive policing](#). However, if the software is to be built with accessible (open-sourced) codes, there are concerns that it would be less robust and useful in predictive policing. The counter-argument is that an open-sourced software could be better scrutinised to ensure programmers were not 'biasing' the algorithms of predictive policing programmes.

What this might mean for waste crime

Open source predicting policing could increase transparency and make information available to the general public in effort to raise awareness and increase knowledge about crime (including waste crime). However, this has to be balanced against the need to restrict how much information is released about the methods used to investigate, track and apprehend criminals.

18. Insurance industry launches risk and compliance support

Experts from across the insurance industry have joined forces to launch a new risk and compliance consultancy - [Implement Compliance Solutions & Resources](#) - to help businesses cope with the changing regulatory and client requirements of Brexit-era Britain.

ICSR is focussed on helping businesses ensure they are compliant with rules on tax, relationships, safety, EU directives, - and have a particular focus at the moment on tax evasion, environmental regulation violations and cybersecurity lapses stemming from Brexit.

ICSR are betting that, with businesses facing an increasingly confusing web of red-tape, there will be increased demand for consulting firms to offer advisory services focusing on assisting organisations achieve compliance in a range of areas. In the increasingly uncertain landscape of the UK's Brexit process, the firm aims to provide clients with compliance expertise, and clarification as to how exactly such laws will affect post-membership business in Britain.

What this might mean for waste crime

The continuing confusion around Brexit and what it means is creating an opportunity for consultancies to provide guidance and advice – and will continue to do so for some time. So those consultancies will be able to establish long term relationships with clients.

Could SmartWaste partners work with these intermediaries to use them as (i) eyes and ears on the ground to provide intelligence about waste regulation compliance and (ii) delivery instruments that are armed with relevant information to pass onto to businesses?

19. UK risks becoming dumping ground for plastic after Brexit

The UK risks becoming the “dirty man of Europe” after Brexit with no plan to deal with the [millions of plastic bottles](#) dumped by consumers every week, [the guardian reports](#).

The article goes on to point out that the EU is currently drawing up a circular economy strategy which aims to make manufacturers take greater responsibility for the way the billions of plastic bottles produced each year are disposed of, collected and recycled. But leading EU figures and environmental groups warn that the UK will not be bound by the new deal once outside the EU and so risks [becoming a dumping ground for plastic and other waste](#).

The UK government says it is taking the issue of plastic bottles seriously. A Defra spokesperson said: “We have made great progress in boosting recycling rates for plastic bottles, with their collection for recycling rising from less than 13,000 tonnes in 2000 to over 330,000 tonnes in 2015. We will continue to address the impacts of plastics waste as we leave the EU, as part of our ambition to be the first generation to leave the environment in a better state.”

What this might mean for waste crime

There is [growing concern](#) about ‘the environment shaped hole in Repeal Bill.’

There is growing concern in Europe as well. Pieter Depous, policy director at the [European Environmental Bureau](#), warns that the “frequently touted ‘low tax, low regulation’ economic model suggested by Theresa May will most likely result in lower domestic fees for producer responsibility. There will be fewer incentives to manufacture reusable and recyclable packaging solutions, which will in turn lead to more resources being used and more plastic ending up in the ocean.”

20. Call for EA to hold the government to account post Brexit

Climate Change Committee chairman Lord Deben has said the Environment Agency (EA) will need to be given powers to hold the Government to account if the UK is to enforce environmental regulations effectively after leaving the EU. Speaking at the launch of a [Policy Connect report on the future of environmental regulation following Brexit](#), Lord Deben said the UK needed a mechanism under which ministers are not the “final arbiter.”

The report argues that post-Brexit policy, at the heart of which lies the Repeal Bill, is a “chance for the UK to carry out an overhaul of its environmental policies; to uphold its international commitments, attract long-term investment, fully utilise available research and data and to embed long-term thinking and strategy whilst being transparent and accountable to these objectives”.

The manifesto concludes that “disregarding climate change and environmental regulation post-Brexit would have damaging economic consequences. Embedding this urgent issue into future policy comes with a wealth of benefits for both economy and society associated with becoming a world leader in the sustainable innovation space.”

What this might mean for waste crime

This is a good argument. Might we see an increase in powers and responsibility in the agencies post Brexit?

Imagine you had greater power to do what you really want to do – what exactly would that be...?

Annex 4: Sample Ranking Insights workshop agenda

Aims

The aims of the Ranking Insights workshop are

- To review the horizon scans
- To rank the scans according to importance
- To identify emerging strategic uncertainties that need to be understood in order to deliver smarter regulation of waste
- To identify priorities for action

Agenda

| | |
|-------|---|
| 9.45 | Tea/coffee & networking |
| 10.00 | Introduction, workshop aims and objectives |
| 10.15 | Overview of the scanning paper |
| 10.30 | Group exercise 1: Ranking the scans |
| 12.00 | Plenary review |
| 12.30 | Lunch |
| 1.00 | Introduction to group exercise 2 |
| 1.30 | Group exercise 2: Identifying risks and evidence needs |
| 2.45 | Tea |
| 3.00 | Plenary review and discussion: moving projects towards action |
| 3.30 | Next steps |
| 3.45 | Close |

Annex 5: Methodology for scoring the scans

Scoring the scans

Workshop participants score each scan through a 5 stage process where they

1. Assign the scan an impact score (1=low, 5=high) that reflects the scale of impact it might have on
 - the economy [A]
 - the environment [B]
 - society [C]
2. Assign the scan a likelihood score (1=unlikely, 5=likely) that reflects how likely it is that the issue it describes will affect waste crime
3. Identify the approximate time horizon at which the main impacts will be seen (H1, H2 or H3)
4. Calculate the average impact: $(A+B+C)/3$
5. Multiply it by likelihood to give the overall importance score

Participants mark the score for each scan on a matrix handed to them in the workshop as a task sheet (see Annex 6):

| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| | | | | | |

Once (or as) participants complete each ranking, the facilitator takes the score and draws it up on the impact matrix.

So, an individual scan – assume scan number 1 – may score the following

| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| 11.0 | 4 | 4 | 3 | 3 | H2 |

Another scan – scan number 2, say - may score differently

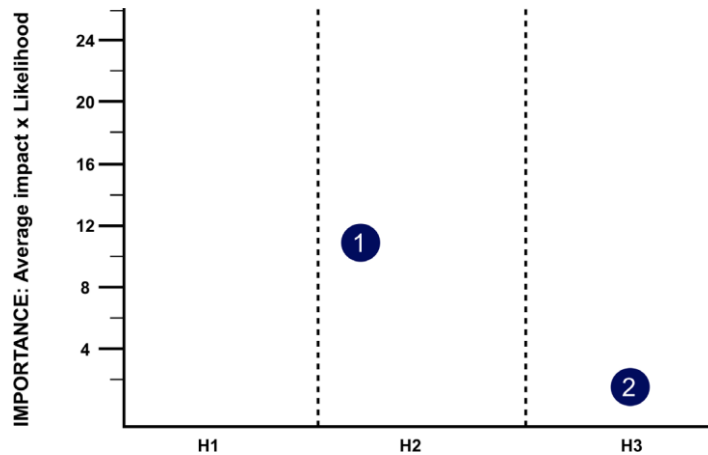
| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| 1.3 | 1 | 2 | 1 | 1 | H3 |

Mapping the scans

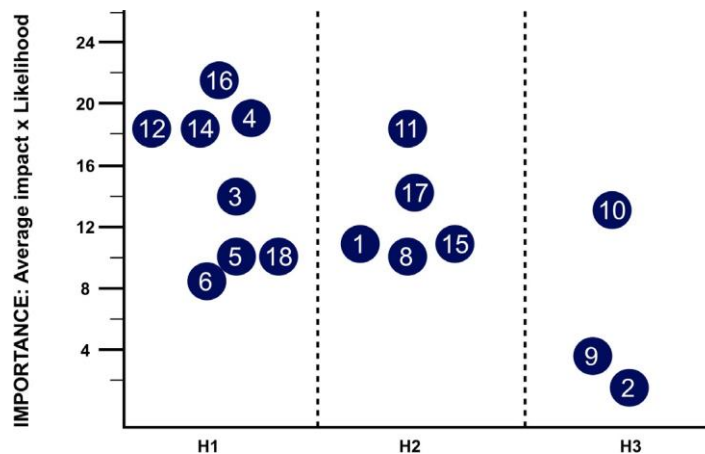
The workshop facilitator should gather the individual scores and map them on the importance matrix as the groups work.

The vertical axis of the importance matrix is overall importance (average impact x likelihood). The horizontal axis is divided into three segments that represent Horizon 1, Horizon 2 and Horizon 3. You can view these as single time zones if you wish, although groups will generally think of them as a continuous time scale.

On this matrix, scan 1 – with an overall importance score of 11.0 – and scan 2 – with an overall importance score of 1.3 map as follows:



The full map will therefore look something like this:



Annex 6: Sample workshop task sheets

Ranking Insights Task Sheet

This task sheet is taken from the workshop Cranfield ran for LIFE SMART partners in August 2017. The group assessed the impact of the scans presented in Annex 3.

The list of scans

1. Data-driven governance
2. Innovation in public service delivery
3. Anticipating criminal behaviour
4. Who cares? The role of popular media
5. Regulatory reform
6. Smart citizens control their own data
7. The age of Thatcher's grandchildren
8. 'Smart contracts' to legitimise financial transactions
9. New tools to build trust
10. Smart tyres
11. Oceans of data
12. Betting on the data
13. There's an app for that
14. Hotspot analysis: pinpointing actors in the supply chain causing the biggest problems
15. 'Localised' circular economy solutions
16. New legislation to tackle waste smugglers
17. Open vs closed access predictive policing
18. Insurance industry launches risk and compliance support
19. UK risks becoming dumping ground for plastic after Brexit
20. Call for EA to hold the government to account post Brexit

Assign each scan an importance score

For each scan

1. Discuss what insight(s) about future waste crime you get from it
2. Assign the scan an impact score (1=low, 5=high) that reflects the scale of impact it might have on
 3. the economy [A]
 4. the environment [B]
 5. society [C]
6. Assign the scan a likelihood score (1=unlikely, 5=likely) that reflects how likely it is that the issue it describes will affect waste crime
7. Identify the approximate time horizon at which the main impacts will be seen (H1, H2 or H3)
8. Calculate the average impact: $(A+B+C)/3$
9. Multiply it by likelihood to give the overall importance score

Scan # _____

| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| | | | | | |

Scan # _____

| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| | | | | | |

Scan # _____

| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| | | | | | |

Scan # _____

| Overall Importance score | Impact | | | Likelihood | Time horizon |
|--------------------------|----------|---------------|----------|------------|--------------|
| | Economic | Environmental | Societal | | |
| | | | | | |

Deepening Insights Task Sheet

Who's in your group?

What issue are you discussing?

What risk or opportunity does the issue pose to the economy, the environment and [or] society?

How might the risk or opportunity manifest between now and the identified time horizon?

What needs to be done to mitigate the risk/exploit the opportunity?

What evidence gaps you need to fill - what do you need to know or track - to ensure your response is effective?

What are your first steps and when do they need to be done by?

Who (agencies, personnel) needs to be involved?

Who is responsible for taking this forward?

- lead

- support

Annex 7: Sample output from a scanning workshop exercise

This Annex provides an illustration of the kind of output to expect from a **Deepening insights** discussion about an issue in a scanning paper

The example is drawn from a workshop where the group worked with scan 16 (see Annex 3), set out below.

New legislation to tackle waste smugglers

China has launched a one-year campaign, [National Sword 2017](#), to tackle waste smugglers. The legislation specifically targets 'foreign waste' as well as agricultural products, resource products, tax-related good, drugs, guns and other illegal smuggling activities. The Chinese Government is seeking to strengthen its co-operation with a number of responsible organisations to coordinate implementation and enforcements of laws.

This cooperative approach has led to a [major crackdown on organised criminal gangs involved in the smuggling of solid waste](#). For example, a team consisting of 172 officers from customs, environmental protection, inspection and quarantine, and industry and commerce, raided 16 warehouses in the city of Guangdong and recovered smuggled plastics and metals to value of RMB 1billion (£115m).

What this might mean for waste crime

The [European Commission](#) has stated that fighting environmental (including waste) crime requires:

- a comprehensive multidisciplinary approach at all levels
- better cooperation and exchange of information between the competent authorities and with third countries
- enhanced dialogue and cooperation with relevant international organisations

Greater cooperation among responsible organisations and tighter regulations advocated internationally raises questions about how this would work in practice, and be sustained in the long-term given resource constraints on regulatory bodies.

The group's responses to the questions are set out on the next page.

What risk or opportunity does the issue pose to the economy, the environment and [or] society?

- Consequences for criminal shipment of goods (e.g. electrical equipment) to China.
- Increased criminal traffic
- Increased exposure to toxic fumes and reduced life expectancy

How might the risk or opportunity manifest between now and the identified time horizon?

- Exploitation of loopholes in controls / regulation, tax and other fiscal pressures against material (residual) demands

What needs to be done to manage the risk/ capture the opportunity?

- Exploit levers of control such as
- public awareness
- buyers/brokers and shippers and importers
- intelligence gathering / monitoring)

What evidence gaps you need to fill - what do you need to know or track - to ensure your response is effective?

- Intel for scarlet offenders
- Targeted areas

What are your first steps and when do they need to be done by?

- Step 1: Agree on scope, budget, and risk level and tolerance
- Step 2: Raise awareness about the 'emerging issue' through dialogue and engagement; communication campaign to run for the entire period
- Step 3: Gather data to determine what is needed: tax data, waste return data, other scan data (mapping, hot spot analysis). Look at development of illegal sites
- Step 4: Intelligence monitoring to assess its effectiveness and impact on the problem

Who (agencies, personnel) needs to be involved?

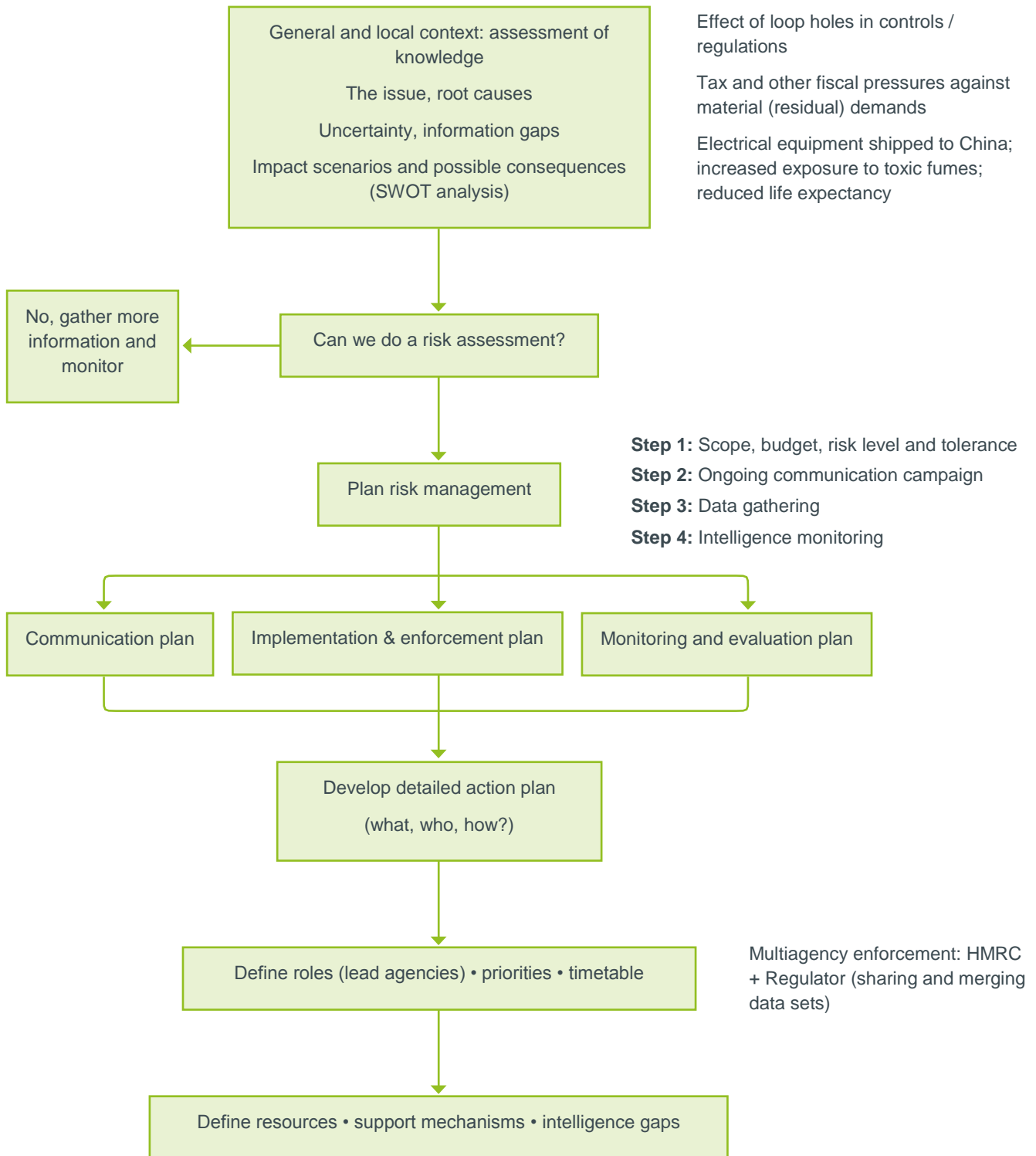
- Multiagency enforcement: HMRC + Regulator (sharing and merging data sets)

Who is responsible for taking this forward?

- EA, SEPA, NRW, HMRC, Police, HSE, DVSA, Border Force, Port Authorities? Home Office Immigration?

Annex 8: Project planning flow chart

This project planning flow chart illustrates how to connect the output from the **insights** stage to the **planning action** stages. The flow chart sets out the process and the output from the discussion on *New legislation to tackle waste smugglers* (Annex 7) is mapped against it to illustrate how to begin.



Annex 9: Building a case for action

Scans can be progressed to action through further exploration of issues in, for example, deep-dive projects. Deep dive projects have the value of delving deeper into insights generated from the scanning to establish a case for action.

These projects are pursued for different purposes:

- To identify potential responses to emerging issues or challenges that are familiar or already on the horizon; i.e. H1 insights around new waste legislation introduced abroad or in Scotland (e.g. China's National Sword legislation or the TEEP regulations in Scotland). In this case, the deep dive focuses on analysing the gaps in knowledge and identifying the resources, skills and capacity needed to effect appropriate actions.
- To develop a better understanding of emerging issues or challenges that have the potential to materialise in the near future if current trends continue; i.e. H2 insights around circular economy innovations that may transform how the industry operates. In this case, the deep dive focuses on developing a better understanding of the 'root' of an emerging issue and the potential opportunities or pressure points for the future, and on developing a framework for monitoring and adapting to change.
- To rethink the case for action, where the shape of the waste and waste crime landscape moving forward remains unclear; i.e. H3 insights around complex supply chain risks and a changing regulatory environment that present new opportunities for criminals. In this case, the deep dive focuses on analysing the extent to which the knowledge gathered may redefine or reduce the intensity of problems, and change the case for intervention and the ownership of policy issues.

It is unlikely that partners will be able to carry out in-depth analysis on every issue raised in the scan so they should aim to identify critical issues and opportunities for individual partners and to identify cross-cutting policy issues that require a coordinated strategic response.

Annex 10: About the authors

Cranfield University and Waverley Consultants have extensive (+16 years) research experience and track record in developing and delivering horizon scanning and foresight studies that support Government with policy development and regulatory review.

Cranfield University has conducted horizon scanning and foresight research for Government Departments/agencies, including delivering a three-year Defra Futures Partnership project (£1.8M); a pan-governmental foresight programme for 9 partners including the Scottish and Welsh Governments, Environment Agency and Natural England. The project has produced scenarios for the UK food and feed system that are informing the development of food policy within the Food Standards Agency, and also water management scenarios for England and Wales that are being used to future-proof river basin management measures within the Environment Agency. The Institute has worked with Natural Resources Wales and CAMERAS (a partnership of Scottish government and private sector organisations) to stress-test their environmental strategies, using the UK National Ecosystem Assessment (NEA) scenarios, to assess the drivers of change for ecosystem services and the implications for the natural environment and human well-being in Scotland and Wales. More recently, the Institute (through Fiona Lickorish) has been instrumental in advising governments and other bodies on the use of foresight in emerging risk identification and analysis, including presenting written and verbal evidence to the UK Government's Science and Technology Select Committee on Government Horizon Scanning (2013/14), the IRGC Guidelines on Emerging Risk Governance (2015), the Lloyd's Register Foundation's foresight report on Engineering Resilience (2015). The Institute (through Kenisha Garnett) is an invited member of the European Food Safety Authority's Standing Working Group on emerging risk identification (2017-2018) and is currently providing expert advice on the development of an emerging risk identification framework (FORENV) for DG Environment, European Commission (2017).

Waverley Consultants (Alister Wilson) has delivered a range of horizon scanning and scenario projects across government and in the private sector. He has worked with the Government Office for Science's Foresight programme and managed their Futures Analysts Network from its launch in 2005 until it wound down in 2010. Alister first worked with SEPA in 2004, when he provided scenario planning training for senior staff and helped develop scenarios for sustainable development. He has worked with SEPA several times since then, first revising the original scenarios and then, in 2011, working with 3rd Horizons to explore the leadership implications of the refreshed scenario set. Alister provided facilitation support to the Board and Management Team as part of the Transformational Change Programme in 2012 and provided futures advice to the Landscape Review in early 2013. Waverley developed the Government Office for Science's Futures Toolkit in 2017.