

Bow-tie Analysis

Presentation Speaking Notes



Created by: Enterprise Risk Management

Version 1



Learning Objective

To become familiar with what Bow-Tie Analysis is as a supporting tool within the risk management process.

Module Content

- ✓What is Bow-Tie Analysis ?
- ✓How Bow-Tie Analysis relates to risk management?
- ✓Illustrative examples
- ✓Bow-Tie Analysis Engagement Framework

By the end of this session, you'll:

- be introduced to the concept and purpose of Bow-Tie Analysis
- understand how it relates to risk management.
- gain further understanding of it as a process through illustrative examples
- know where there are further supports for conducting a Bow-Tie Analysis exercise.



What is Bow-Tie Analysis ?

Let's begin with what is Bow-Tie Analysis?



Bow-Tie Analysis can be used to support risk identification and risk assessment. It helps in identifying the risk event, the potential causes and impacts, as well as the controls (proactive and reactive) in place.

HSE Definition: A tool used to better understand the identified risk event, causes, impacts/consequences and proactive and reactive controls.

Page 56 Table 10 ERM Policy and Procedures 2023

The HSE Policy & Procedures have been updated to include Bowtie analysis. It is a risk assessment tool that visually represents the pathways of risk from causes to potential outcomes.

It helps with identifying the risk event, the potential causes and impacts, as well as the controls (proactive and reactive), which we will discuss in more throughout this session.

The HSE Policy defines it as a tool used to better understand the identified risk event, causes, impacts/consequences and proactive and reactive controls.

Definitions of Bow-Tie Analysis

Bow tie analysis makes sources of risk (hazards), the effectiveness of controls (protective barriers) against harm, the potential outcomes (consequences) of a specific event (top event), and gaps in risk management strategies easily visualisable to and understandable by a wide range of audiences.



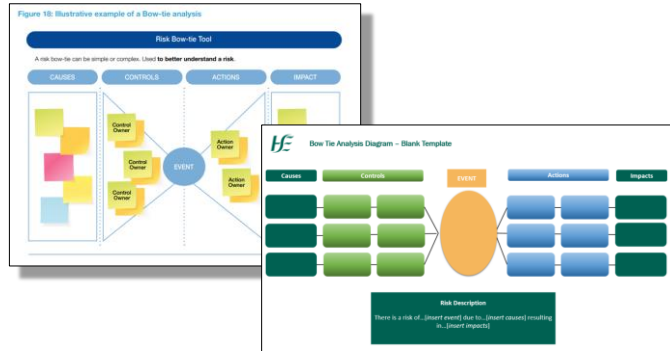
A bow tie is a graphical depiction of pathways from the causes of an event to its consequences. It shows the controls that modify the likelihood of the event and those that modify the consequences if the event occurs. It can be considered as a simplified representation of a fault tree or success tree (analysing the cause of an event) and an event tree (analysing the consequences). Bow tie diagrams can be constructed starting from fault and event trees, but are more often drawn directly by a team in a workshop scenario.

(31010:2019, Risk management - Risk assessment techniques)

Various organisations define Bow tie analysis [BTA] differently. The NHS uses it as a tool to visualize components of risk management and to assist in making it more understandable by a wide range of audiences.

The NSAI describe it as a tool showing the pathways of an event from causes to consequences.

HSE Bow-Tie Analysis Template

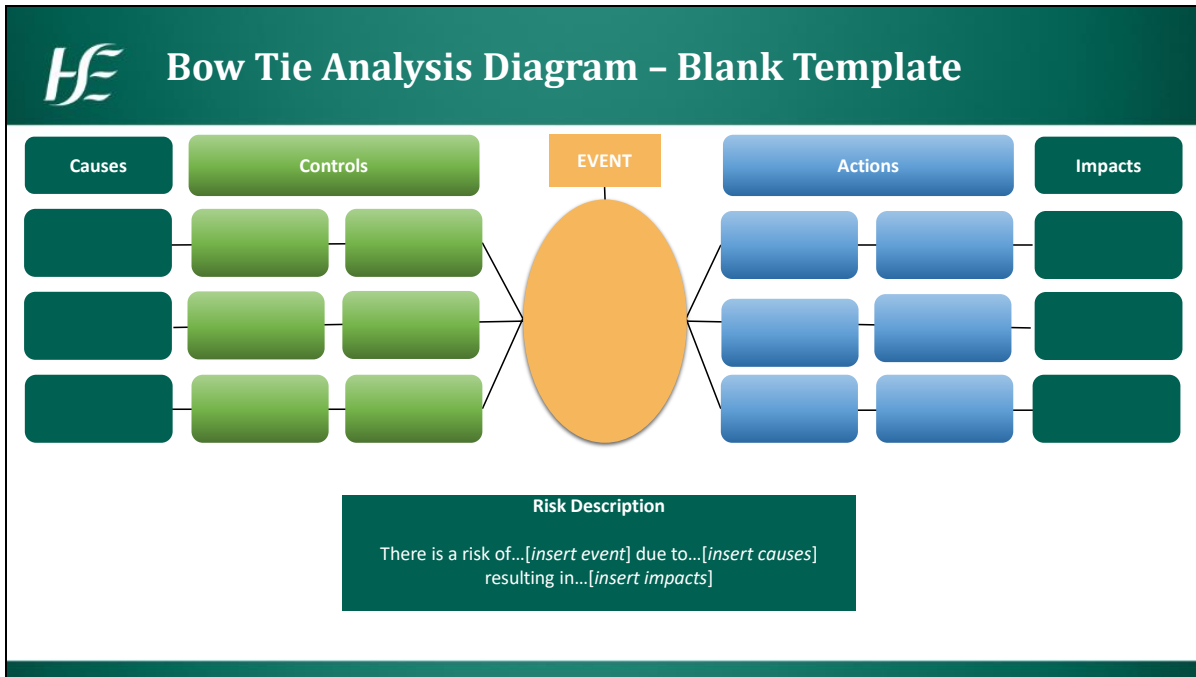


Supporting Tools: <https://www.hse.ie/eng/about/who/riskmanagement/risk-management-documentation/hse-enterprise-risk-management-supporting-tools/>

Simply put, bowtie analysis is a risk assessment tool that visually represents the pathways of risk from causes to potential outcomes. It is called a "bowtie" because the diagram resembles a bowtie, with a central "knot" representing an event, flanked by two sides: one showing causes and proactive controls, and the other showing impacts/consequences and reactive controls.

Bowtie Analysis is a method to support the understanding of risk events and the effectiveness of controls. It provides a clear visual representation of risk paths, making it easier to communicate complex risk information to stakeholders. Within Enterprise Risk Management, Bowtie Analysis helps in identifying and managing both existing and emerging risks, ensuring that proactive and reactive controls are in place to minimise impact.

As mentioned earlier, bow-tie analysis is a supporting tool included in the ERM policy. You can locate a blank template and a worked example on the HSE's risk management supporting tool website, shown here.



Here we have a blank Bow-Tie Analysis diagram and as mentioned earlier Bowtie Analysis helps in identifying and managing both existing and emerging risks, ensuring that proactive and reactive controls are in place to minimise both impact and likelihood.

We will take you briefly through the components of a Bowtie diagram:

Risk Event: The central point or "knot" in the bowtie diagram represents the occurrence of a critical risk event

Causes: Factors that could potentially lead to the event

Proactive Controls: Measures designed to prevent the causes of the event

Impacts: Potential outcomes if the risk event occurs

Treatment plans [reactive controls]: Measures designed to reduce the severity of the consequences if the risk event occurs

This covers the theory element, we have a 10 step guide to support you in the application in the Illustrative Examples section.



What is Bow-Tie Analysis Recap

Let's summarise this first section;

We began by defining the purpose and structure of this training session, aiming to familiarise you with Bow-tie Analysis as a tool in risk management. We introduced you to the concept and purpose of Bow-Tie Analysis to help you understand how it relates to risk management.

We signposted you to the location of supports for conducting a Bow-Tie Analysis exercise. And we have walked you through the component parts of the Bow-tie Analysis.



How Bow-Tie Analysis relates to risk management

To integrate the principles of Bow-Tie Analysis with the risk management procedures described in your Enterprise Risk Management (ERM) Policy and Procedures, let's break down each section of the document and identify how Bow-Tie Analysis can be incorporated.



HSE Enterprise Risk Management Policy and Procedures 2023



Table 2: Sources and Approaches for Identifying Risks

Potential Sources of Information	
Risk Registers	Complaints/Surveys/Investigation Reports
Internal and External Audit Reports	Incident/Near Miss Tracking and Trending
Press	Incident Review Reports
Reviews	Non-conformance reports/performance reports
Policies, Procedures, Protocols and Guidelines	
Examples of Approaches to Identifying Risks	
PESTLE analysis	Benchmarking
Bow-tie Analysis	Meetings/committees
Risk assessment workshops	Data Protection Impact Assessment
Brainstorming	Horizon Scanning
Questionnaires/Surveys	

Page 29 ERM Policy and Procedures 2023

We want to now look at how Bow-tie Analysis as it relates to risk management.

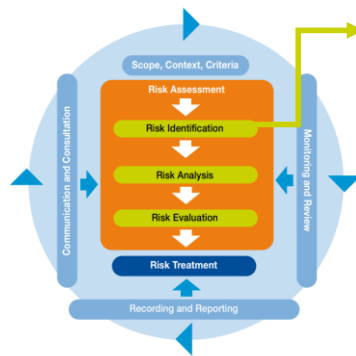
Set out in the Enterprise Risk Management Policy and Procedures is how Bow-tie analysis can be used as an approach for identifying risks, highlighted here from Table 2.

Bow-Tie Analysis can be embedded in the risk identification and assessment phases. It helps in identifying not only the central risk event but also the potential causes (threats) and consequences (impacts), as well as the controls (barriers) in place. The framework could explicitly mention the use of Bow-Tie diagrams as a tool for risk visualisation.

As can be seen, there are other approaches to identifying risk, which can be dependant on the style, size and complexity of the circumstances. For this module we are just focusing on the Bow-tie analysis as a tool.



Risk Identification



Risk Identification (Section 2.2.1)

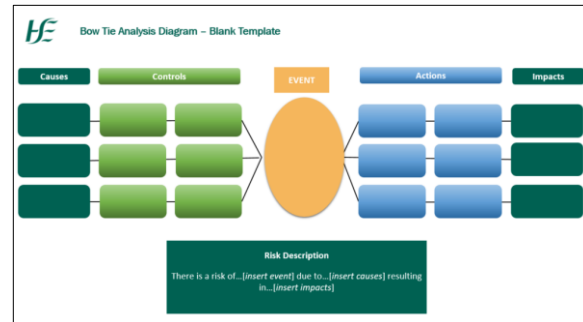
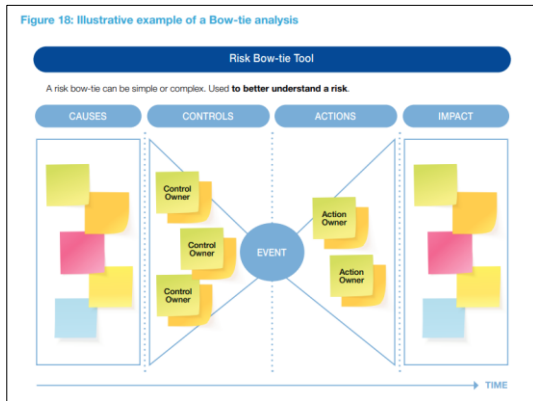
This step involves identifying risks that could affect the achievement of objectives.

Bow-Tie Analysis is used to map out the cause, impacts and associated controls of identified risk events.

So let's review Bow-tie analysis through the HSE's Risk Management Process lens.

In Risk Identification (Section 2.2.1) we can use the Bow-tie analysis to map out the cause, impacts and associated controls of identified risk events.

HSE Risk Identification

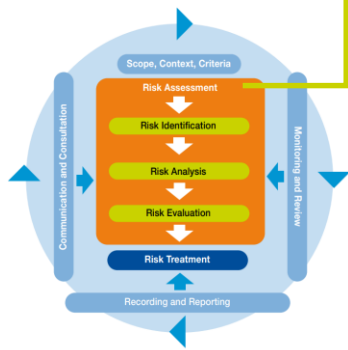


Page 61 ERM Policy and Procedures 2023

To support you, the HSE has developed a Bowtie analysis tool in MS PowerPoint Format, which is available to download from the HSE website.

The website includes a template for use as well as a worked example.

HSE Risk Assessment



Risk Assessment (Sections 2.2.1; 2.2.2; 2.2.3)

The assessment process evaluates the likelihood and impact of risks. Bow-Tie Analysis supports the identification of controls (preventive and reactive) and understanding the potential severity of impacts if those controls fail, which assists in the evaluation of the strength of the controls and the evaluation of the risk rating.

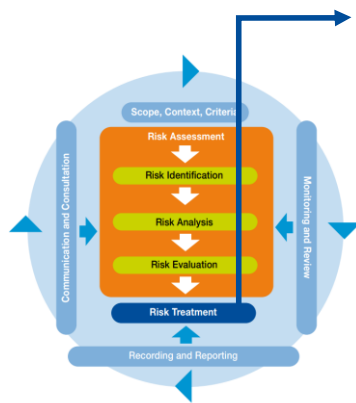
Sections 2.2.1 Risk Identification 2.2.2 Risk Analysis 2.2.3 Risk Evaluation [pages 18-20 in the policy]

Bow-Tie Analysis supports the identification of controls (preventive and reactive) and understanding the potential severity of impacts if those controls fail, which assists in the evaluation of the strength of the controls and the evaluation of the risk rating.

Simply put risk assessment involves the measuring of the likelihood and impact of risk and bow tie supports the understanding of these.



Risk Treatment



Risk Treatment (Section 2.3)

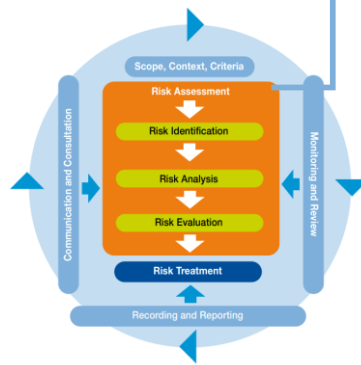
This section outlines how the organisation responds to identified risks, including risk treatment approaches.

The Bow-Tie Analysis plays an important part in risk treatment by highlighting where additional controls might be needed. It helps in deciding whether to terminate, accept, transfer or reduce the risk by visualising the effectiveness of existing controls and the potential need for new controls.

Next, is the development of Risk Treatment plans (Section 2.3)
Bow-Tie diagrams provide insights into where additional controls or corrective actions might be necessary and support the identification of appropriate risk treatment plans.



Monitoring and Review



Monitoring and Review (Sections 2.6 & 3.8)

This section discusses the ongoing monitoring and reporting of risks.

Bow-Tie diagrams can be used as part of the monitoring process to continuously monitor the status of controls. They provide a visual tool for reporting on risk, making it easier to communicate with stakeholders.

Monitoring and Review (Sections 2.6 and 3.8)

We need to regularly review and update our risk register to reflect outcomes of the Bow-tie analysis. This means monitoring and reassessing risks as new information becomes available.



Monitoring and Review

- Bow-Tie Analysis is performed by senior management and department heads/managers with the involvement of key stakeholders to include advisors, healthcare professionals, and frontline staff who provide valuable insights from their experience.
- Regular reviews of Bow-Tie diagrams should be included in this process, ensuring that they remain up-to-date with the latest risk information and that controls are still effective.

Here's examples of who should perform a Bow-tie analysis.

•**Senior management:** They oversee the corporate plan, NSP and strategy and can identify long-term trends affecting healthcare.

•**Department heads and managers:** They understand the specific risks within their departments or units.

•**Key stakeholders:** This includes external advisors, healthcare professionals, and frontline staff who provide valuable insights from their experience.

Regular reviews of Bow-Tie diagrams should be included in this process, ensuring that they remain up-to-date with the latest risk information and that controls are still effective



How Bow-Tie Analysis relates to risk management - Recap

To recap, the Bow-Tie Analysis can be used as a structured method to visualise risks, linking potential causes and consequences through a central event.

We've seen how BTA is used within the risk management process:

- Risk Identification: Bow-Tie Analysis helps in visualising and identifying the causes and consequences of critical risks
- Risk Assessment: By assessing the effectiveness of existing controls, the Bow-Tie method supports a more refined risk assessment process.
- Risk Treatment: Bow-Tie diagrams provide clear insights into where additional controls or corrective actions might be necessary
- Monitoring and Reporting: These diagrams can be used to monitor the status of controls and provide clear, visual reports to stakeholders on the current risk landscape.



Illustrative Examples

Let's look at ten steps on how to use a Bow-tie Analysis diagram followed by some examples of Bow-tie Analysis applied in different contexts. The following examples are used for illustrative purposes and are not real life examples from within our Health Service.



Using the Bow-tie Analysis Diagram – 10 steps

1. Add Event in the centre box.
2. List causes of the Event in the Causes section on the left hand side.
3. List impacts of the Event in the Impact section on the right hand side.
4. List the controls – proactive [pre-event] and reactive [post-event].
5. Link proactive controls and causes.
6. Link reactive controls and impacts.
7. Look for causes with no controls.
8. Consider if causes with no controls should become an action, that is, to put a future control in place.
9. Only list as a control if it is in place and working effectively to reduce either the cause or the impact.
10. Allocate an action owner for each action plan.

To support you through conducting a Bow-tie Analysis engagement we have developed an engagement framework available on the HSE Website which provides a structured approach to facilitate that process within your team or group. The 10 process steps shown here may be used to guide you through the completion of the Bow-tie Analysis diagram. Successful bow tie analysis involves collaboration with key stakeholders whose insights can support the identification of risks to the achievement of objectives.

Please refer to the engagement framework document for further details.

Over the following slides we will walk through some worked examples.

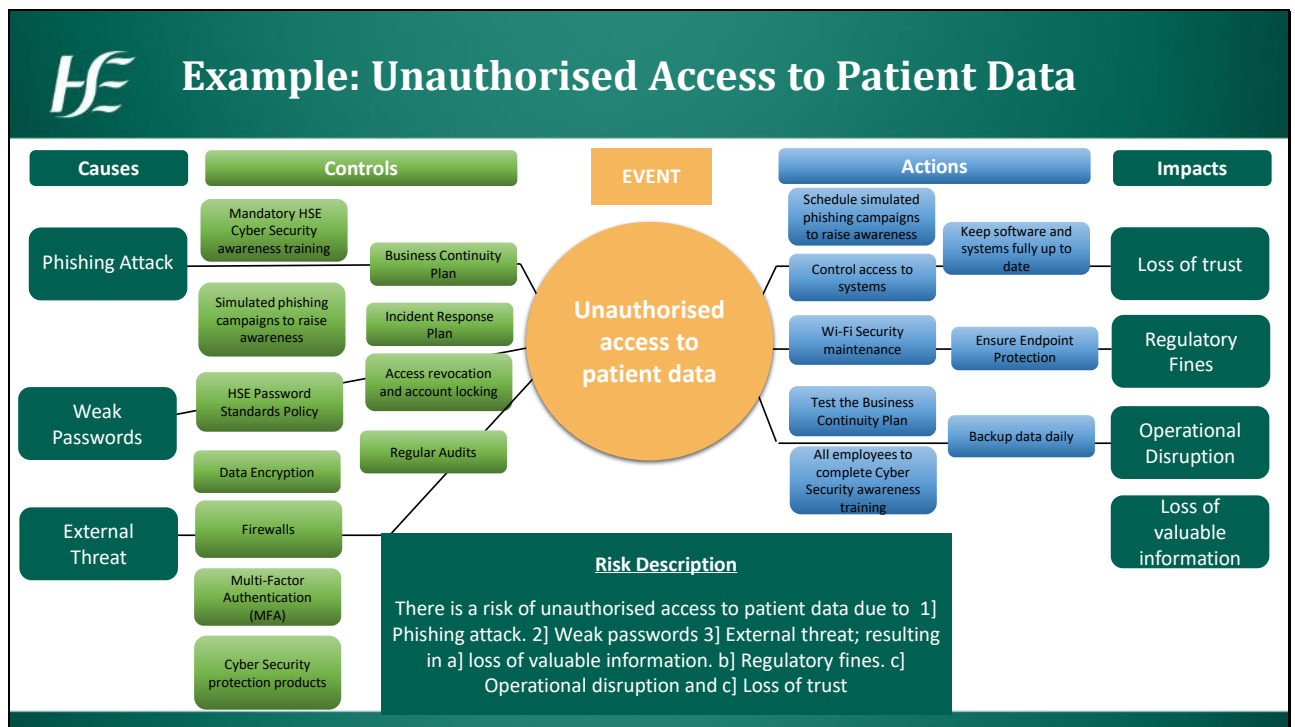


Example 1 – for illustrative purposes only

Risk Event – Unauthorised Access to Patient Data

Causes	Reactive Controls
<ul style="list-style-type: none">- Phishing Attack- Insider Threat- Weak Passwords	<ul style="list-style-type: none">- Incident Response Plan- Access revocation and account locking- Regular Audits
Proactive Controls	Impacts
<ul style="list-style-type: none">- Employee Training- Multi-Factor Authentication (MFA)- Password Management Policies	<ul style="list-style-type: none">- Loss of trust- Regulatory Fines- Operational Disruption

So here we have an illustrative example. The risk event is 'Unauthorised Access to Patient Data' and the cause, impact and controls have been set out as shown here. You will note that the controls have been divided into proactive controls [which prevent and provide direction] and reactive controls [which aim to detect and correct] risks. For each cause we identify a relevant control on the left hand side. The next slide will show how the example in this table can be captured on a Bow-tie Analysis template. Further guidance on controls is available in the HSE ERM Policy & Procedures.



Each of the elements are plotted on the template.

Example 1:

Risk Event: The central point or "knot" in the bowtie diagram represents the occurrence of a critical risk event. In this scenario we have identified the Risk Event as 'Unauthorised Access to Patient Data'. The **purpose of identifying the central event in a bow tie analysis is** to understand a critical future risk event / threat to the organisation.

Next we list on the left hand side the **causes and controls which contribute to preventing the risk event materialising**. These they help us reduce or manage the likelihood of central event occurring;

Causes may include a Phishing Attack where an employee/s click on malicious links or providing credentials to cyber criminals.

Preventive Controls may include employee training. Regular cybersecurity awareness training can help to recognise phishing and social engineering tactics.

Then we list on the right hand side the possible impact/consequences of the risk event, in order to understand the severity of the risk and plan treatment strategies.

Impacts may include loss of trust as any breach could cause harm to our service users or staff and severely damage the reputation of the HSE.

Followed by listing actions. Actions minimise the impact after the event, these are also referred to as reactive Controls and may include responses such as an Incident Response

Plan. This is a well-documented and practiced plan to quickly address and contain a data breach.

By conducting the bow tie analysis in this way it helps you to visualise the risks around a specific central event. It shows both what can cause the event and how you can prevent it, as well as what can be done to reduce the damage if the event does materialise. This makes it easier to manage risks. It also assists in understanding where we have gaps and what additional steps need to be taken to mitigate the risk.

Note: Causes without controls, consider if an action is required. Too many controls? Consider if they are working to reduce the likelihood or the impact of the risk event. If not, consider if they should be included.



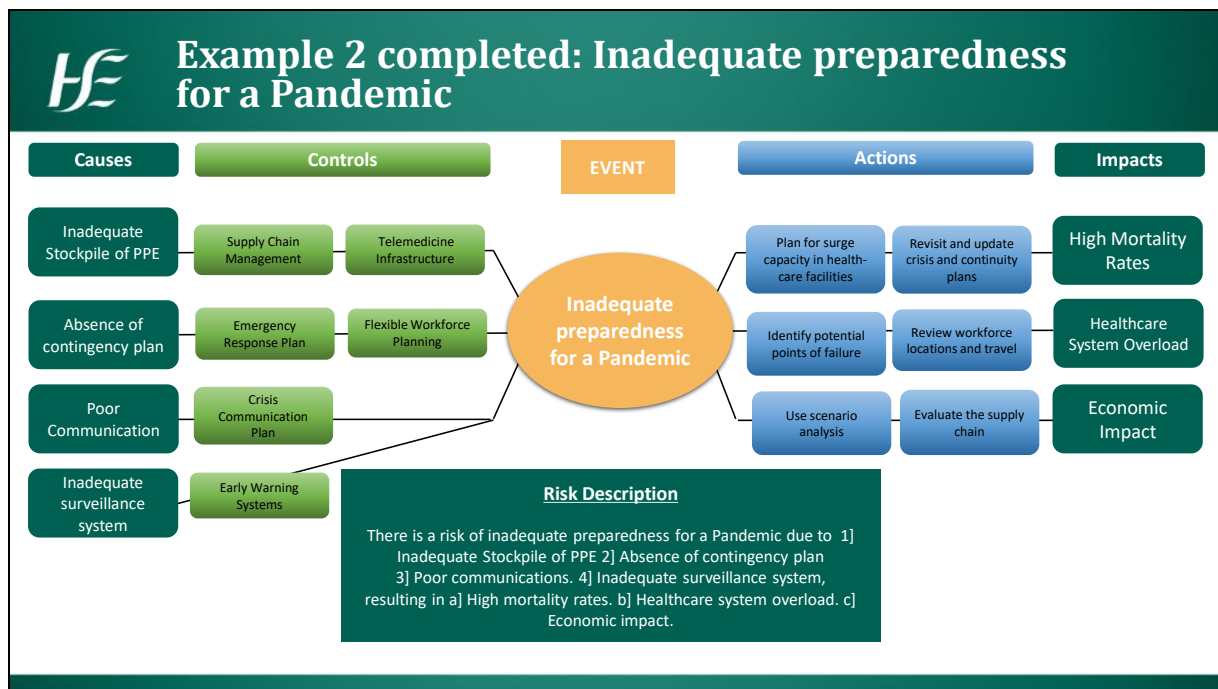
Example 2 – for illustrative purposes only

Risk Event – Inadequate Response to a Pandemic Outbreak

Causes	Reactive Controls
<ul style="list-style-type: none">- Inadequate Stockpile of PPE- Slow Government Response- Poor Communication	<ul style="list-style-type: none">- Crisis Communication Plan- Flexible Workforce Planning- Telemedicine Infrastructure
Proactive Controls	Impacts
<ul style="list-style-type: none">- Preparedness Planning- Supply Chain Management- Early Warning Systems	<ul style="list-style-type: none">- High Mortality Rates- Healthcare System Overload- Economic Impact

Our second illustrative example related to health care is: 'Pandemic Response' and the cause, impact and controls have been set out as shown here. Similar to our previous example will note that the controls have been divided into proactive controls [which prevent and provide direction] and reactive controls [which aim to detect and correct] risks. Further guidance on controls is available in the HSE ERM Policy & Procedures.

We will demonstrate how this is plotted on the bow tie template.



The central point or "knot" in the bowtie diagram represents the occurrence of a critical risk event. In this scenario we have identified the Risk Event as 'Inadequate preparedness for a Pandemic'.

The **purpose of identifying the central event in a bow tie analysis** is to understand a critical future risk event / threat to the organisation.

Next we list on the left hand side the **causes and controls which contribute to preventing the risk event materialising**. These they help us reduce or manage the likelihood of central event occurring;

Causes may include an inadequate or insufficient stockpile of PPE for healthcare workers.

Proactive controls may include Emergency Response Plan which involves developing and maintaining a comprehensive pandemic response plan, including resource allocation.

Then we list on the right hand side the possible impact/consequences of the risk event, in order to understand the severity of the risk and plan treatment strategies.

Impacts may include increased patient deaths.

Followed by listing actions. Actions minimise the impact after the event, these are also referred to as Reactive controls and may include a Crisis Communication Plan. This is a pre-established communication strategy to ensure clear and consistent messaging to the public and staff.

By conducting the bow tie analysis in this way it helps you to visualise the risks around a specific central event. It shows both what can cause the event and how you can prevent it, as well as what can be done to reduce the damage if the event does materialise. This makes it easier to manage risks. It also assists in understanding where we have gaps and what additional steps need to be taken to further manage the risk.



Illustrative Examples Recap

To recap, in this section we have covered:

- 10 proposed steps to follow when conducting a bow tie analysis
- Walked you through two illustrative examples, firstly **Unauthorised Access to Patient Data** and secondly **Inadequate Response to a Pandemic Outbreak**, demonstrating each of the bow tie analysis elements.

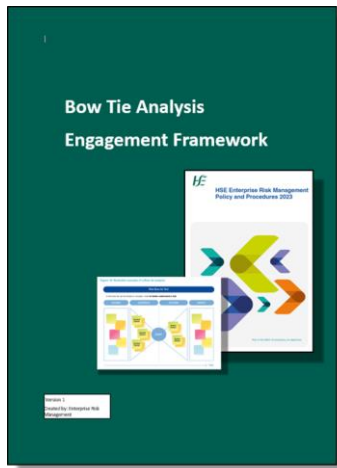


Bow-Tie Analysis Engagement Framework

Now that we have introduced the concept of Bow-Tie analysis, its application by way of risk management and shared some illustrative examples, next is a brief overview of what supports are in place for you to engage with colleagues in carrying out a Bow-Tie analysis exercise.



Bow-Tie Analysis Engagement Framework



Engagement Framework: For trainers.

Online Training: An overview of Bowtie Analysis and its importance in healthcare risk management, including a walkthrough of the Bowtie diagram components with healthcare-specific examples.

Hands-On Exercise: Group activity to create a Bowtie Diagram for a chosen scenario [see notes below and suggested answers] and discussion and feedback.

Additional Resources: Link to supporting tools.

Facilitation Guide: For trainers.

As mentioned earlier, to further assist you with Bow-tie Analysis engagements with your colleagues, a brief four page 'Bow-Tie Analysis Engagement Framework' has been developed and is available on the supporting tools website. This sets out all the elements that are required to engage with relevant stakeholders including the resources, tools and each step to follow in the process.

It includes the learning objectives and agenda for the engagement as well as suggested timeframes for each step of the process and materials that will be required



Bow-Tie Analysis Engagement Framework

Supporting Tools:

<https://www.hse.ie/eng/about/who/riskmanagement/risk-management-documentation/hse-enterprise-risk-management-supporting-tools/>

erm.queries@hse.ie



Further supporting tools are available on the website on this link.

Please email erm.queries@hse.ie for further queries.



Bow-Tie Analysis Engagement Framework Recap

The Bow-Tie analysis Engagement Framework is there to assist you in preparing and meeting with colleagues and stakeholders in carrying out a Bow-Tie analysis engagement.

Copies of these slides and speaking notes are also made available to further enhance the understanding in this area.

Remember to use all the available templates and tools for effective Bow-Tie analysis.



Thank you

In conclusion, in this module's training on Bow-Tie analysis we have set out to assist your understanding of Bow-Tie analysis in enterprise risk management by defining it and exploring how it supports risk identification and risk assessment. We have explained how it helps us in identifying the risk event, the potential causes and impacts, as well as the controls (proactive and reactive) in place.

We introduced a Bow-Tie analysis template which helps document and analyse risks effectively and we have provided worked examples to assist in completion of templates. We then signposted to the framework for Bow-Tie analysis engagements so as to equip you with a set of tools to help anticipate future risks and opportunities.

For any further questions or assistance, please refer to the Enterprise Risk Management Policy and Procedures 2023 and the HSE website or contact the ERM team at erm.queries@hse.ie if you have any further queries.

Thank you for your attention.