Ponemon INSTITUTE

2012 Cost of Cyber Crime Study: United Kingdom

Sponsored by HP Enterprise Security

Independently conducted by Ponemon Institute LLC

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Benchmark Study of UK Organisations

Ponemon Institute October 2012

Part 1. Executive Summary

We are pleased to present the *2012 Cost of Cyber Crime Study: United Kingdom*. Sponsored by HP Enterprise Security, this is the first year the study was conducted in the UK to better understand the economic impact a cyber attack can have on an organisation. The benchmark study is based on a representative sample of 38 organisations in various industry sectors.

The first *Cost of Cyber Crime Study* was conducted in the U.S. in 2010 and is now in its third year. In addition to the UK, this year the scope of the research was expanded to include organisations in Germany, Australia and Japan. The findings from this research are presented in separate reports.

Cyber attacks generally refer to criminal activity conducted via the Internet. These attacks can include stealing an organisation's intellectual property, confiscating online bank accounts, creating and distributing viruses on other computers, posting confidential business information on the Internet and disrupting a country's critical national infrastructure. Disruption to business processes and revenue losses create the highest costs for organisations following a cyber attack.

Key takeaways from this report include:

- Cyber crimes are costly. We found that the average annualised cost of cyber crime for the 38 organisations in our study is £2.1 million per year, with a range of £.4 million to £7.7 million.
- Cyber attacks have become common occurrences. The companies in our study experienced 41 successful attacks per week or 1.1 successful attacks per organisation per week.
- The most costly cyber crimes are those caused by malicious insiders, denial of services, and malicious code. Mitigation of such attacks requires enabling technologies such as SIEM, intrusion prevention systems, application security testing and enterprise governance, risk management and compliance (GRC) solutions.

The purpose of this benchmark research is to quantify the economic impact of cyber attacks and observe cost trends over time. We believe a better understanding of the cost of cyber crime will assist organisations in determining the appropriate amount of investment and resources needed to prevent or mitigate the devastating consequences of an attack.

Our goal is to be able to quantify with as much accuracy as possible the costs incurred by organisations when they have a cyber attack. In our experience, a traditional survey approach would not capture the necessary details required to extrapolate cyber crime costs. Therefore, we decided to pursue field-based research that involved interviewing senior-level personnel and collecting details about actual cyber crime incidents. Approximately nine months of effort was required to recruit companies, build an activity-based cost model, collect source information and analyze results.

This research culminated with the completion of case studies involving 38 organisations. For consistency purposes, our benchmark sample consists of only larger-sized organisations (i.e., more than 1,000 enterprise seats[1]).

The focus of our project was the direct, indirect and opportunity costs that resulted from the loss or theft of information, disruption to business operations, revenue loss and destruction of property, plant and equipment. In addition to external consequences of the cyber crime, the analysis attempted to capture the total cost spent on detection, investigation, containment, recovery and after-the-fact or "ex-post" response.

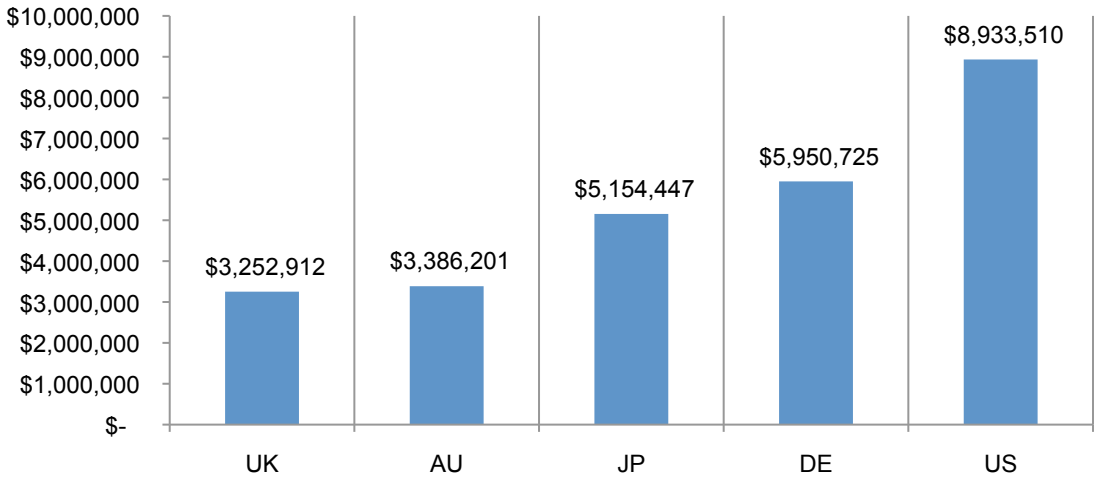
[1] Enterprise seats refer to the number of direct connections to the network and enterprise systems.

Global at a glance

As discussed above, the study has been conducted in the US for three years and this is the first year we included United Kingdom, Germany, Australia and Japan. Some of the most interesting similarities and differences are presented below.

Figure 1 presents the estimated average cost of cyber crime for five country samples after conversion into US dollars. As shown, there is significant variation among companies in the benchmark samples. The US sample reports the highest total average cost at $8.9 million and the UK sample reports the lowest total average cost at $3.3 million.

Figure 1. Total cost of cyber crime in five countries
Costs expressed in US dollars, n = 199 separate companies



Possible reasons for these differences may be the types and frequencies of attacks experienced as well as the importance that each company places on the theft of information assets versus other consequences of the incident.

We found that US companies were much more likely to experience the most expensive types of cyber attacks, which are malicious insiders, malicious code and web-based incidents. Similarly, UK and Australian were most likely to experience denial of service attacks. In contrast, German companies were least likely to experience malicious code and denial of services. Japanese companies were least likely to experience malicious insiders and web-based attacks.

Another key finding that may explain cost differences among countries concerns the theft of information assets. US and German companies report this as the most significant consequence of a cyber attack. On the other hand, UK and Australia attach more importance to business disruption. As noted later in this report, business disruption can be less costly than information theft.

With respect to internal activity costs, we also found interesting differences. Specifically, the cost of detecting a cyber attack appears to be the most expensive for German companies. The cost of recovery from a cyber incident appears to be more expensive for companies in the UK and Australia. It is interesting to note that Japanese companies cite higher costs to investigate and manage the incident than the other countries.

Summary of UK findings

Following are the most salient findings of this year's study. These findings focus on the factors that affect the cost of cyber crime for organisations.

Cyber crimes are costly. We found that the median annualised cost for 38 benchmarked organisations is £2.1 million per year, with a range from £.4 million to £7.7 million each year per company.

Cyber crime cost varies by organisational size. Results reveal a positive relationship between organisational size (as measured by enterprise seats) and annualised cost. However, based on enterprise seats, we determined that smaller-sized organisations incur a significantly higher per capita cost than larger-sized organisations (£399 versus £89).

All industries fall victim to cybercrime, but to different degrees. The average annualised cost of cyber crime appears to vary by industry segment, where defence, utilities and energy and financial service companies experience higher costs than organisations in hospitality, retail and education.

Cyber crimes are intrusive and common occurrences. The companies participating in our study experienced 41 successful attacks per week – or about 1.1 successful attacks per organisation.

The most costly cyber crimes are those caused by malicious insider, denial of service and malicious code. These account for more than 44 percent of all cyber crime costs per organisation on an annual basis. Mitigation of such attacks requires enabling technologies such as SIEM, intrusion prevention systems, application security testing solutions and enterprise GRC solutions.

Cyber attacks can get costly if not resolved quickly. Results show a positive relationship between the time to contain an attack and organisational cost. The average time to resolve a cyber attack was 24 days, with an average cost to participating organisations of £135,744 over this 24-day period. Results show that malicious insider attacks can take more than 50 days on average to contain.

Disruption to business processes and revenue losses represent the highest external costs. This is followed by theft of information assets.[2] On an annualised basis, disruption to business or lost productivity account for 38 percent of external costs. Costs associated with revenue losses and theft of information assets represent 53 percent of external costs.

Recovery and detection are the most costly internal activities. On an annualised basis, recovery and detection combined account for 55 percent of the total internal activity cost with cash outlays and labor representing the majority of these costs.

Deployment of security intelligence systems makes a difference. The cost of cyber crime is moderated by the use of security intelligence systems (including SIEM). Findings suggest companies using security intelligence technologies were more efficient in detecting and containing cyber attacks. As a result, these companies enjoyed an average cost savings of £.4 million when compared to companies not deploying security intelligence technologies.

Deployment of enterprise security governance practices moderates the cost of cyber crime. Findings show companies that have adequate resources, appoint a high-level security

[2]In the context of this study, an external cost is one that is created by external factors such as fines, litigation, marketability of stolen intellectual properties and more.

leader, and employ certified or expert staff experience cyber crime costs that are lower than companies that have not implemented these practices. This so-called “cost savings” for companies deploying good security governance practices is estimated at more than £.3 million, on average.

A strong security posture moderates the cost of cyber attacks. We utilize a well-known metric called the Security Effectiveness Score (SES) to define an organisation’s ability to achieve reasonable security objectives.[3] The higher the SES, the more effective the organisation is in achieving its security objectives. The average cost to mitigate a cyber attack for organisations with a high SES is substantially lower than organisations with a low SES score.

[3]The Security Effectiveness Score has been developed by PGP Corporation and Ponemon Institute in its annual encryption trends survey to define the security posture of responding organisations. The SES is derived from the rating of 24 security features or practices. This method has been validated from more than 30 independent studies conducted since June 2005. The SES provides a range of +2 (most favorable) to -2 (least favorable). Hence, a result greater than zero is viewed as net favorable.

Part 2. Report Findings

Ponemon Institute's *2012 Cost of Cyber Crime Study: United Kingdom* examines the total costs organisations incur when responding to cyber crime incidents and include the following: Detection, recovery, investigation and incident management, ex-post response and cost containment. These costs do not include a plethora of ongoing expenditures and investments made to sustain an organisation's security posture or compliance with standards, policies and regulations.

Cyber crimes are costly for participating organisations

The economic impact of a cyber attack is wide ranging and is influenced by a variety of factors discussed in this report. The total annualised cost of cyber crime for the 2012 benchmark sample of 38 organisations ranges from a low of £.4 million to a high of £7.7 million. Participating companies were asked to report what they spent and their in-house activities relating to cyber crimes experienced over four consecutive weeks. Once costs over the four-week period were compiled and validated, the reported figures were then grossed-up to present an extrapolated annualised cost.

Figure 2 shows the median annualised cost of cyber crime in the study benchmark sample is £1.5 million. The grand mean value is £2.1 million.

Figure 2. The Cost of Cyber Crime

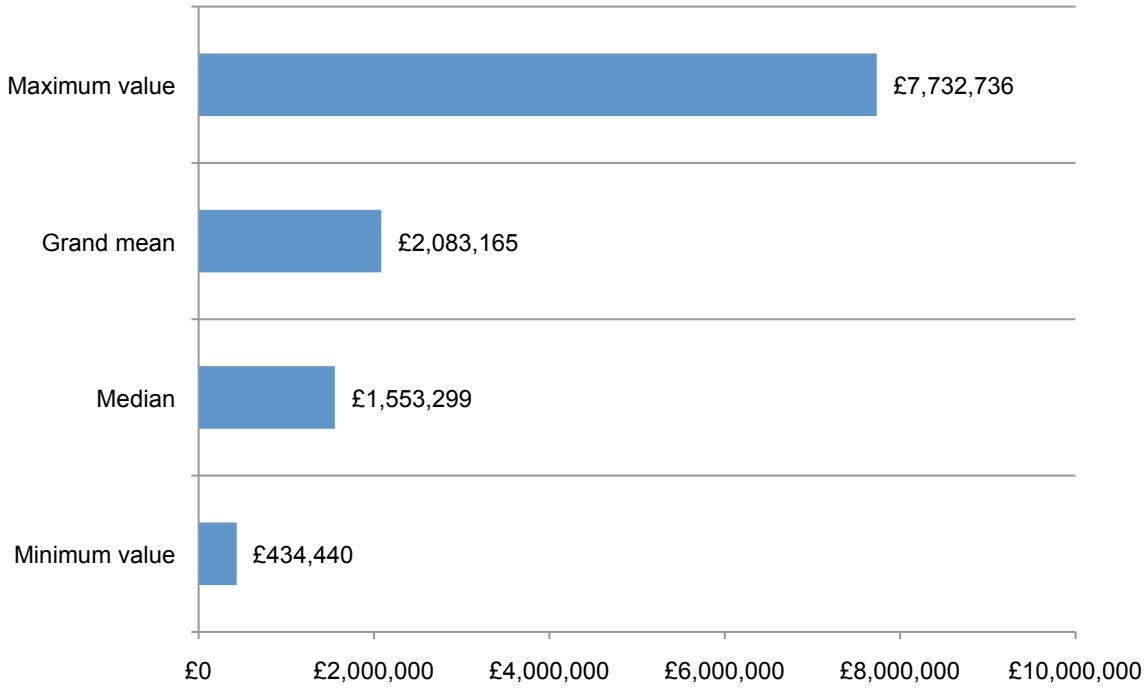
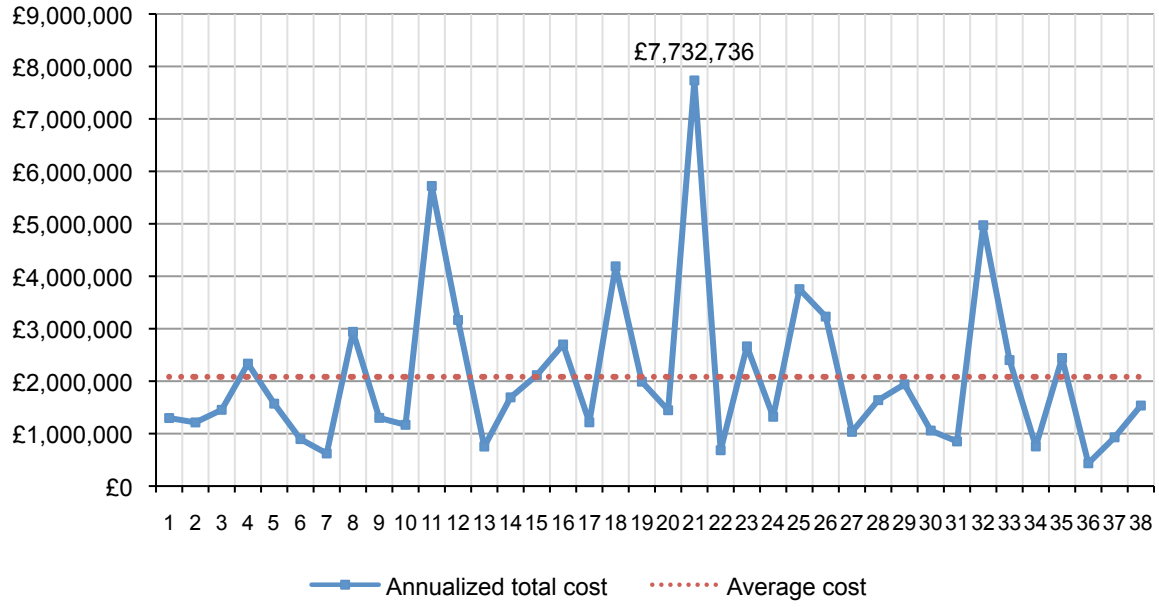


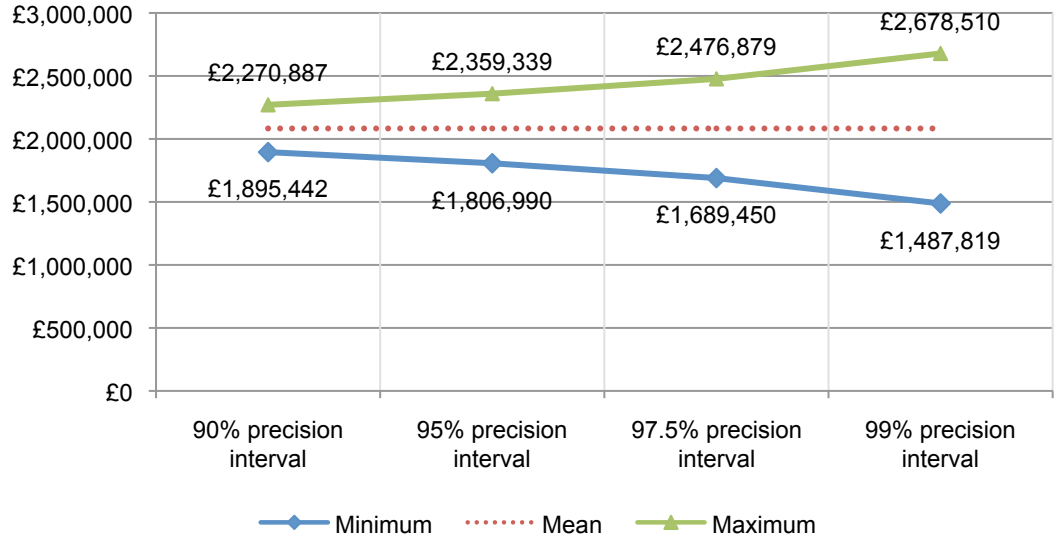
Figure 3 reports the distribution of annualised total cost for 38 companies. As can be seen, 24 of organisations in our sample incurred total costs below the mean value of £2.1 million, thus indicating a skewed distribution. The highest cost estimate of £7.7 million was determined not to be an outlier based on additional analysis. Two other organisations experienced an annualised total cost of cyber crime at or above £5 million.

Figure 3. Total cost of cyber crime for 38 participating companies



As part of our analysis, we calculated a precision interval for the average cost of £2.1 million. The purpose of this interval is to demonstrate that our cost estimates should be thought of as a range of possible outcomes rather than a single point or number. The range of possible cost estimates widens at increasingly higher levels of confidence, as shown in Figure 4.

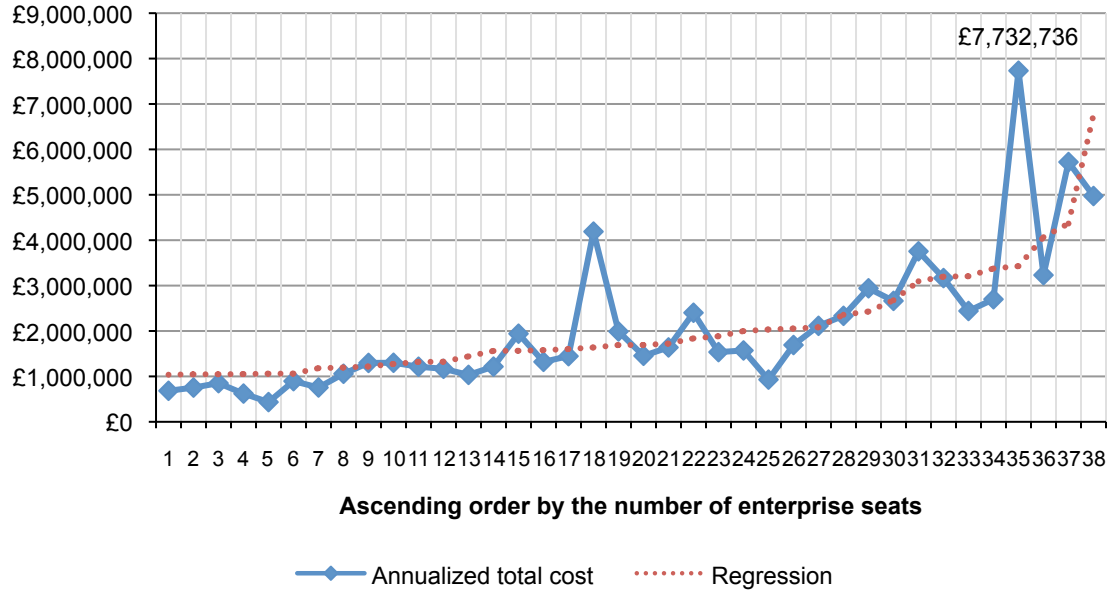
Figure 4. Precision interval for the mean value of annualised total cost



The cost of cyber crime varies by organisational size

As shown in Figure 5, organisational size, as measured by the number of enterprise seats or nodes, is positively correlated to annualised cyber crime cost. This positive correlation is indicated by the upward slopping regression line.

Figure 5. Annualised cost in ascending order by the number of enterprise seats
Regression performed on enterprise seats ranging from 1,009 to 95,600



The following tables show that organisational size can influence the cost of cyber crime.

Organisations are placed into one of four quartiles based on their total number of enterprise seats (which we use as a size surrogate). We do this to create a more precise understanding of the relationship between organisational size and the cost of cyber crime. Table 1 shows the quartile average cost of cyber crime for 2012.

Table 1: Quartile analysis	FY 2012 (n=38)
Quartile 1	£816,749
Quartile 2	£1,681,790
Quartile 3	£1,741,046
Quartile 4	£3,932,220

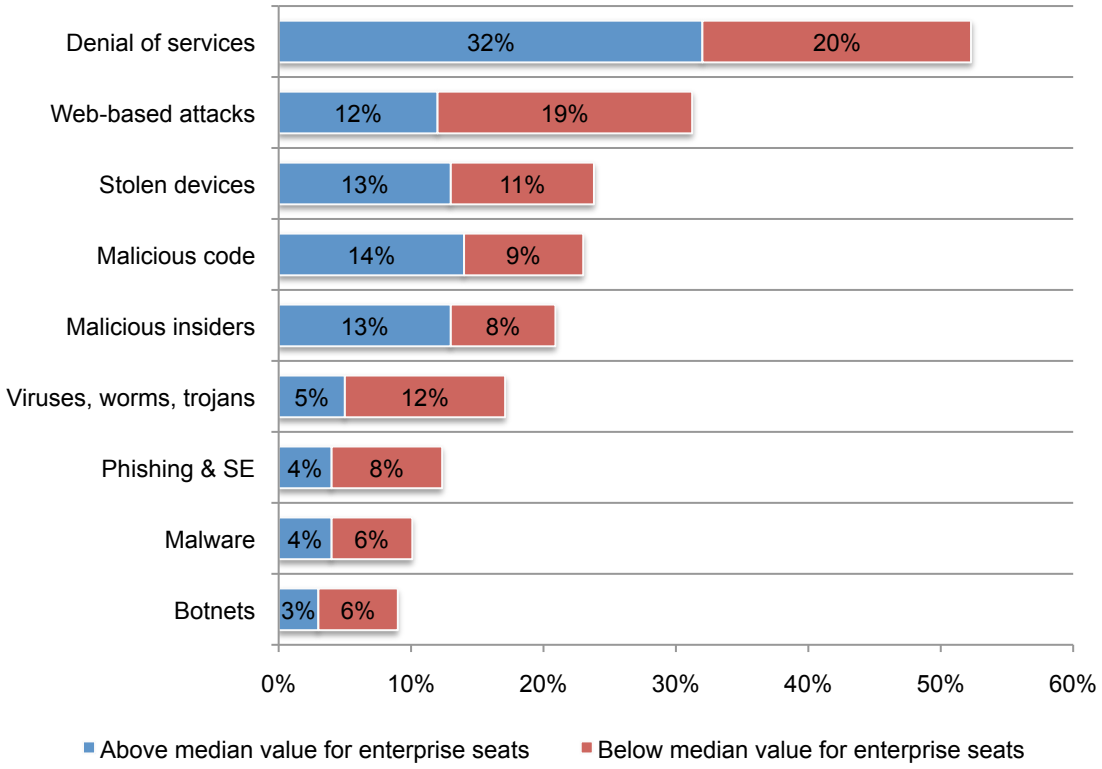
Table 2 reports the average cost per enterprise seat (a.k.a. per capita cost) compiled for four quartiles ranging from the smallest (Quartile 1) to the largest (Quartile 4). The 2012 average per capita cost for organisations with the fewest seats is more than 4 times higher than the average per capita cost for organisations with the most seats.

Table 2. Quartile analysis	2012 cost per seat
Quartile 1 (smallest)	£399
Quartile 2	£195
Quartile 3	£107
Quartile 4 (largest)	£89

A comparison of smaller and larger-sized organisations split by the sample median of 11,819 seats reveals that the cost mix for specific cyber attacks varies by organisational size.

Smaller organisations (below the median) experience a higher proportion of cyber crimes relating to viruses, worms, trojans, phishing, malware, botnets and web-based attacks. In contrast, larger-sized organisations (above the median) experience a higher proportion of costs relating to malicious code, denial of services, malicious insiders and stolen devices.

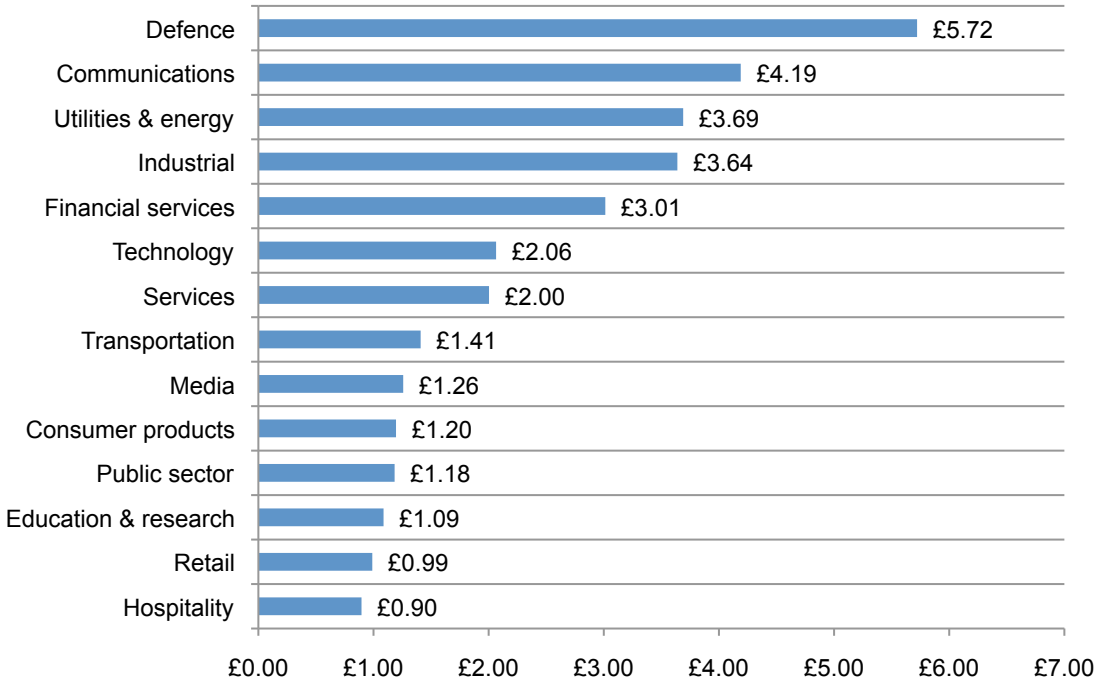
Figure 6. The cost mix of attacks by organisational size
Size measured according to the number of enterprise seats within the participating organisations



The cost of cyber crime impacts all industries

The average annualised cost of cyber crime appears to vary by industry segment. As seen in Figure 7, defence, communications, utilities & energy and industrial companies experience substantially higher costs. Organisations in hospitality, retail and education appear to have a lower overall cyber crime cost.[4]

Figure 7. Average annualised cost by industry sector
£1,000,000 omitted

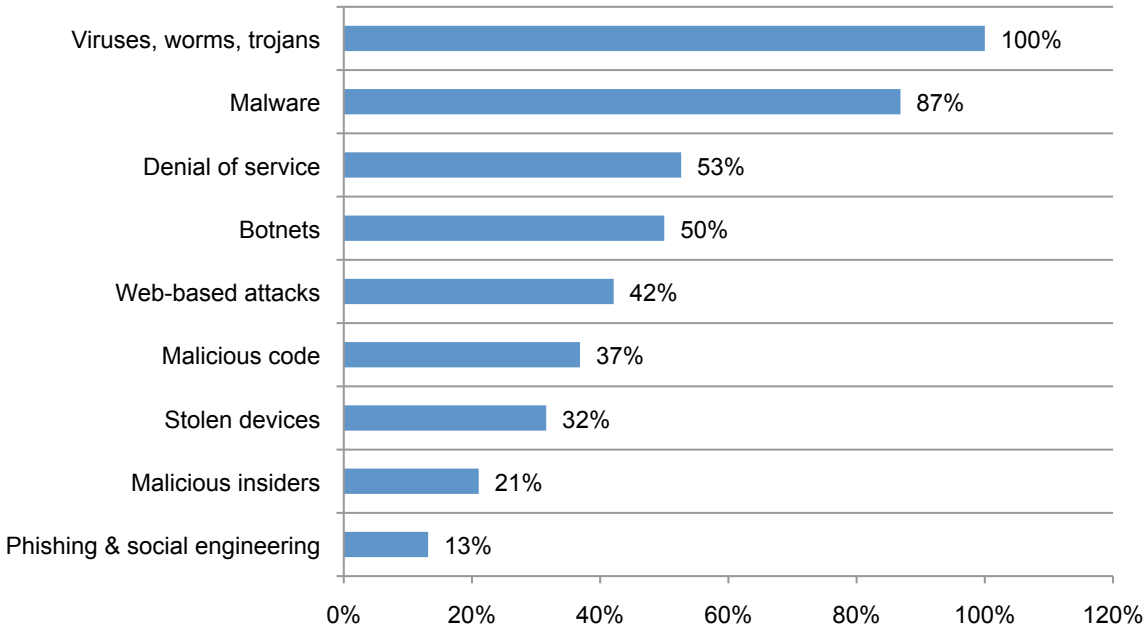


[4]This analysis is for illustration purposes only. The sample sizes in all three years are too small to draw definitive conclusions about industry segment differences.

Cyber crimes are intrusive and common occurrences

The benchmark sample of 38 organisations experienced 41 discernible and successful cyber attacks per week, which translates to 1.1 successful attacks per benchmarked organisation each week. Figure 8 summarises in percentages the types of attack methods experienced by participating companies. Virtually all organisations experienced attacks relating to viruses, worms and/or trojans over the four-week benchmarking period. Eighty-seven percent experienced malware attacks,[5] 53 percent had denial of services attacks, 50 percent experienced botnets and 42 percent experienced Web-based attacks.

Figure 8. Types of cyber attacks experienced by 38 benchmarked companies
The percentage frequency defines a type of attack categories experienced

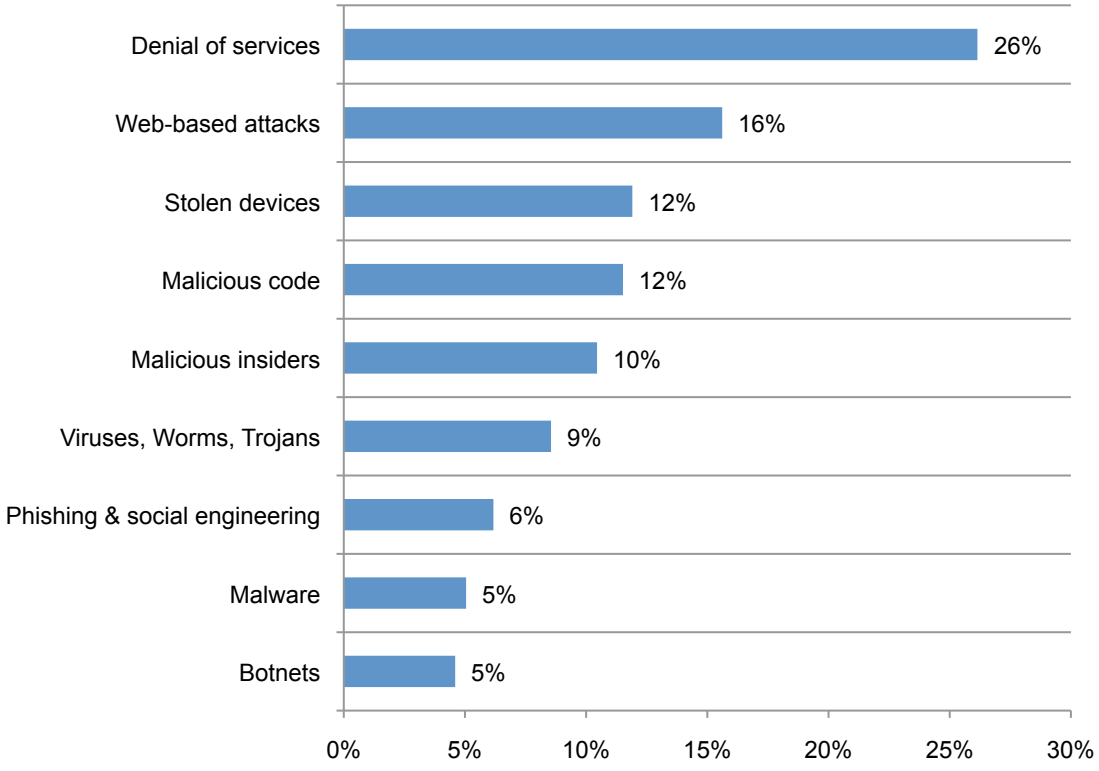


[5]Malware attacks and malicious code attacks are inextricably linked. We classified malware attacks that successfully infiltrated the organisations' networks or enterprise systems as a malicious code attack.

Costs vary considerably by the type of cyber attack

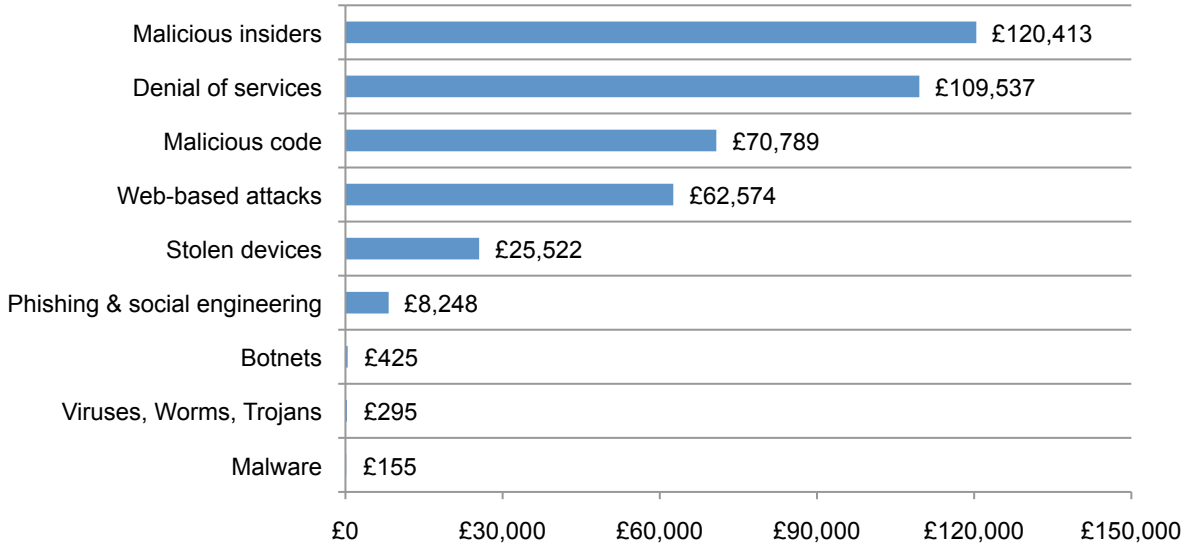
Figure 9 shows the percentage of annualised cyber crime cost allocated to nine attack types compiled from all benchmarked organisations. Denial of service (DoS) and web-based attacks account for the two highest percentage cyber cost types. The least costly concern botnets, malware, and phishing. In total, the top three attacks account for more than 54 percent of the total annualised cost cyber crime experienced by 38 companies.

Figure 9. Percentage annualised cyber crime cost by attack type



While Figure 9 shows the average percentage of cost according to attack type, Figure 10 reveals the most to least expensive cyber attacks when analyzed on per incident basis. The top two are malicious insiders and denial of services, followed by malicious code and web-based attacks. In the context of our study, malicious insiders include employees, temporary employees, contractors and, possibly, business partners.

Figure 10. Average annualised cyber crime cost weighted by attack frequency



Time to resolve or contain cyber crimes increases the cost

The average number of days to resolve cyber attacks is 24 with a maximum of 80 days. The average cost was £135,744 over the 24-day period. Figure 11 shows the annualised cost of cyber crime in ascending order by the average number of days to resolve attacks. The regression line shows an upward slope, which suggests cost and time variables are positively related.

Figure 11. Average days to resolve attack in ascending order
Estimated average time is measured for each given organisation in days

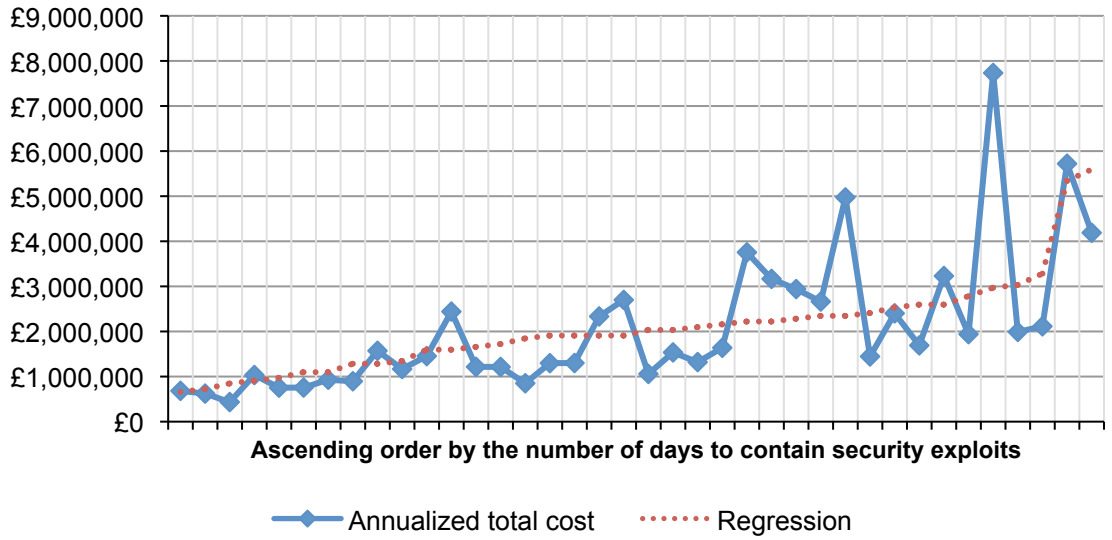
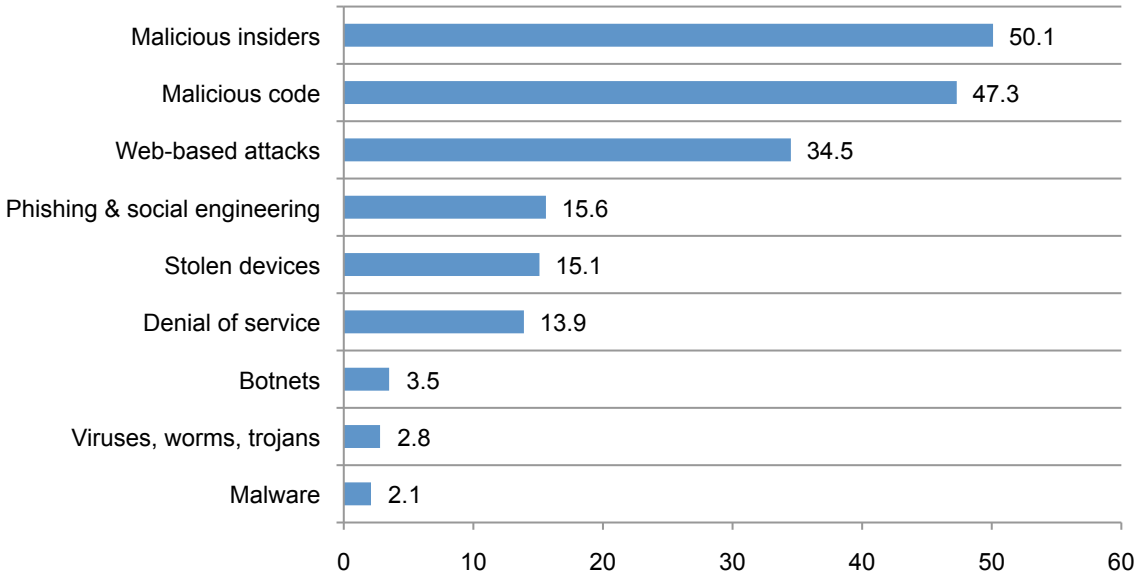


Figure 12 reports the average days to resolve cyber attacks for nine different attack types studied in this report. It is clear from this chart that it takes the most amount of time, on average, to resolve attacks from malicious insiders, malicious code and web-based attackers (hackers).

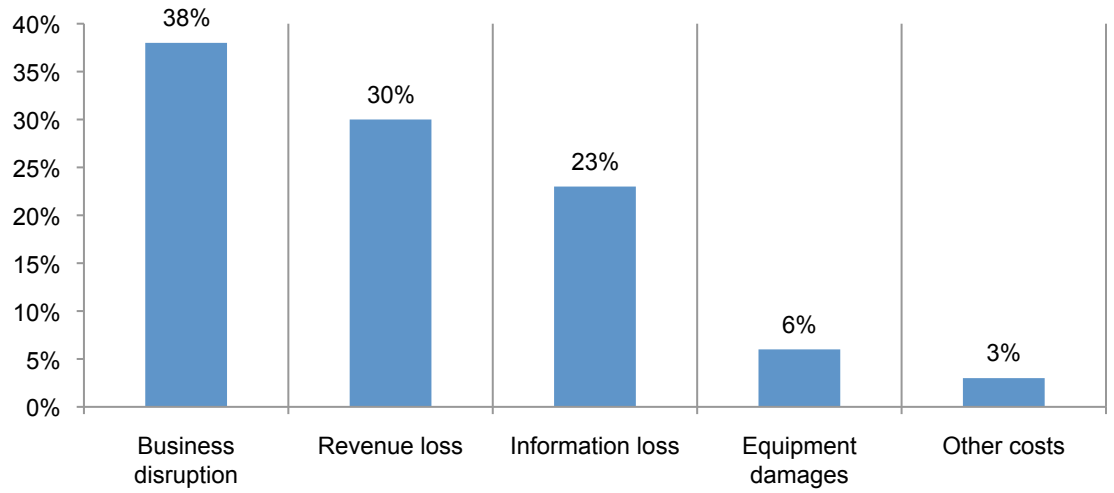
Figure 12. Average days to resolve attack
Estimated average time is measured for each attack type in days



Business disruption and revenue loss represents the highest external cost

As shown in Figure 13, at the top end of the external cyber crime cost spectrum is business disruption. On an annualised basis, it accounts for 38 percent of total external costs. Revenue losses account for 30 percent of total external costs. Information loss (23 percent) and equipment damages (6 percent) yield a much lower cost impact.

Figure 13. Percentage cost for external consequences
Other cost includes direct and indirect costs that could not be allocated to a main external cost category

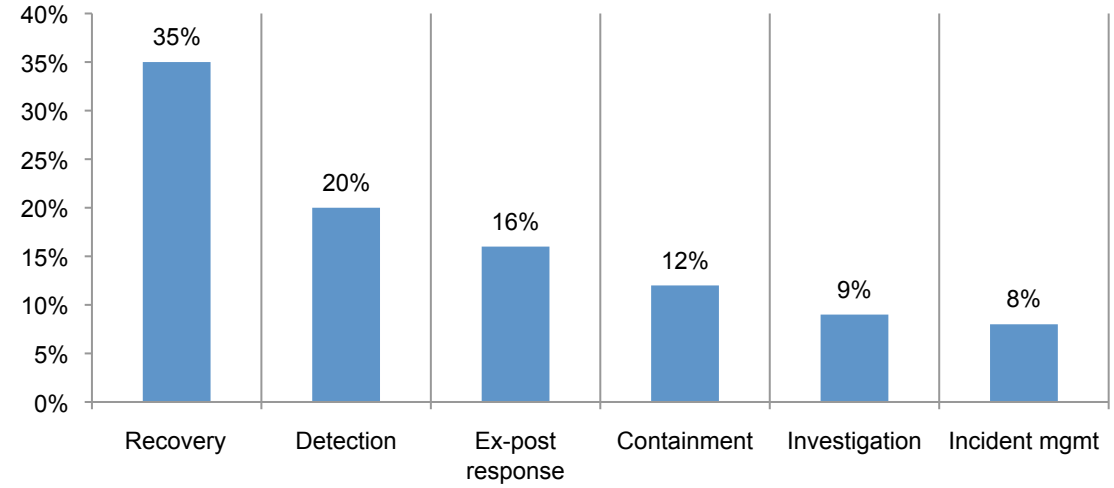


Recovery and detection are the most costly internal activities

Cyber crime recovery and detection cost activities account for 55 percent of total internal activity costs as shown in Figure 14. This is followed by ex-post response (i.e., after the fact response, or remediation) at 16 percent.

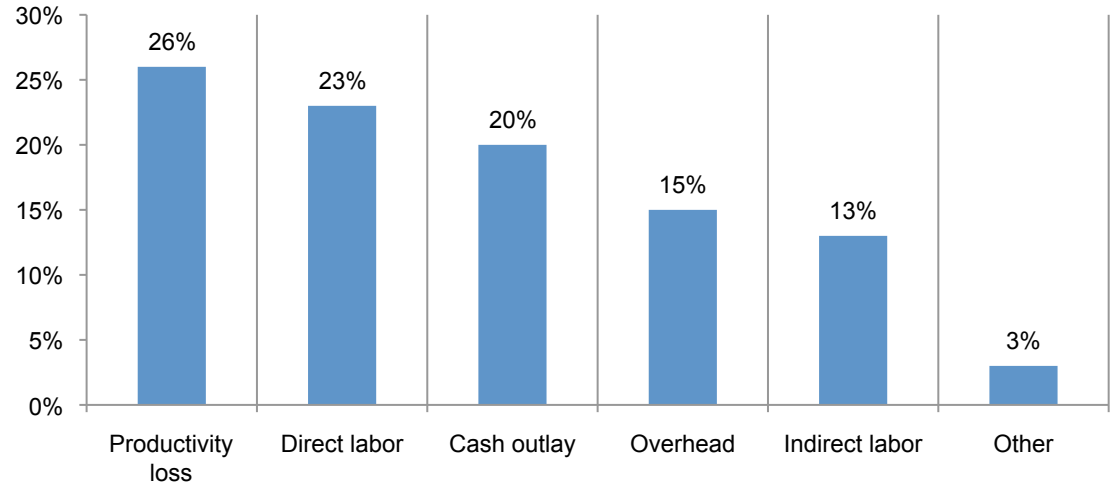
Containment and investigation each represent 12 and 9 percent of internal activity cost, respectively. Incident management represents the lowest internal activity cost (8 percent). These cost elements highlight a significant cost-reduction opportunity for organisations that are able to automate recovery and detection activities through enabling security technologies.

Figure 14. Percentage cost by internal activity centre
Investigation includes escalation activities



The percentage of annualised costs can be further broken down into six specific expenditure components, which include lost productivity (26 percent), direct labor (23 percent), cash outlays (20 percent), overhead (15 percent) and indirect labor (13 percent) as shown in Figure 15.

Figure 15. Percentage activity cost by six specific cost components

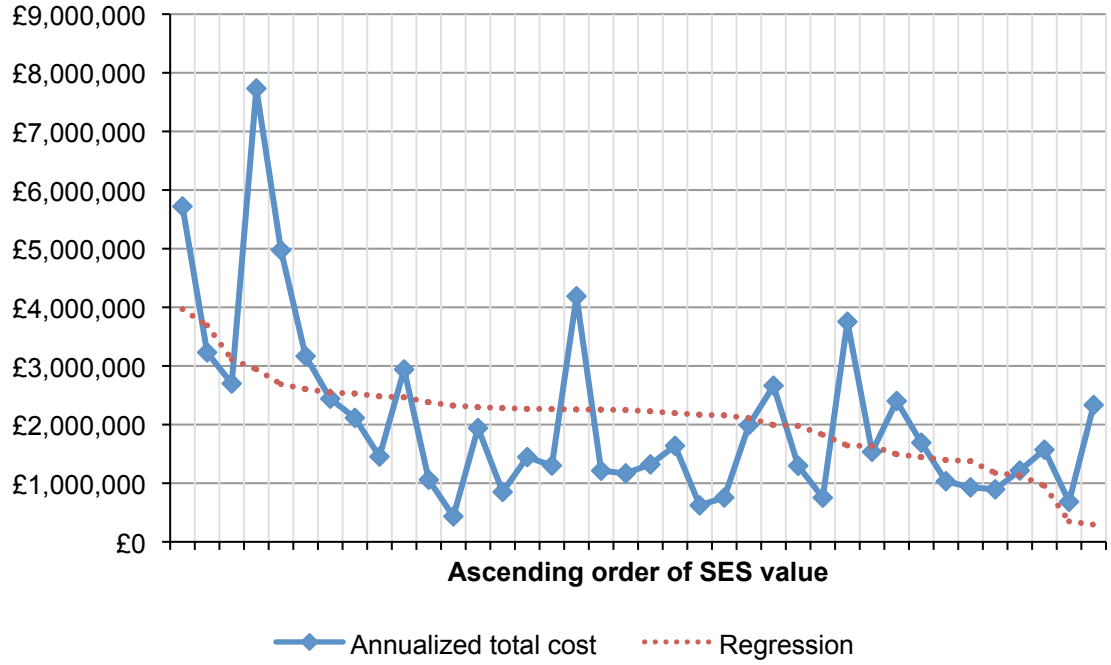


The organisation's security posture influences the cost of cyber crime

We measure the security posture of participating organisations as part of the benchmarking process. Figure 16 reports the annualised cost and regression of companies in ascending order of their security effectiveness as measured by the SES (see footnote 3).

The figure shows a downward sloping regression, suggesting that companies with a stronger security posture experience a lower overall cost. The SES range of possible scores is +2 (most favorable) to -2 (least favorable). Compiled results for the present benchmark sample vary from a low of -1.18 to a high of +1.45, with a mean value at +.17.

Figure 16. Annualised cost in ascending order by SES value
Regression performed on SES ranging from -1.18 to +1.45



A comparison of organisations grouped into four quartiles based on SES reveals cost differences. Table 3 shows the average cost for companies in quartile 1 is £1.42 million, while the average cost for quartile 4 is substantially higher at £3.72 million. This analysis suggests that the company's security posture has a favorable affect on the total annualised cost of cyber crime.

Table 3. Quartile analysis £1,000,000 omitted	2012 total cost
Quartile 1 (highest SES)	£1.42
Quartile 2	£1.64
Quartile 3	£1.65
Quartile 4 (lowest SES)	£3.72

Organisations deploying security intelligence technologies realise a lower annualised cost of cyber crime.

Figure 17 reports the annualised cost of cyber crime allocated for the five cost activity centres explained previously. The figure compares companies deploying and not deploying security intelligence systems. As can be seen, companies using security intelligence systems experience a lower cost in three of five activity centres. The largest cost differences in millions pertain to investigation and incident management (£.57 million vs. £.18 million), detection (£.53 million vs. £.32 million) and containment (£.29 million vs. £.22 million) activities, respectively.

Figure 17. Activity cost comparison and the use of security intelligence technologies
£1,000,000 omitted

Figure 18 shows seven enabling security technology categories experienced by a subset of benchmarked companies. Each bar represents the percentage of companies fully deploying the stated technology. The top three technology categories include: extensive deployment of encryption technologies (50 percent), security intelligence systems (47 percent) and advanced perimeter control and firewall technologies (45 percent).

Figure 18. Seven enabling security technologies deployed

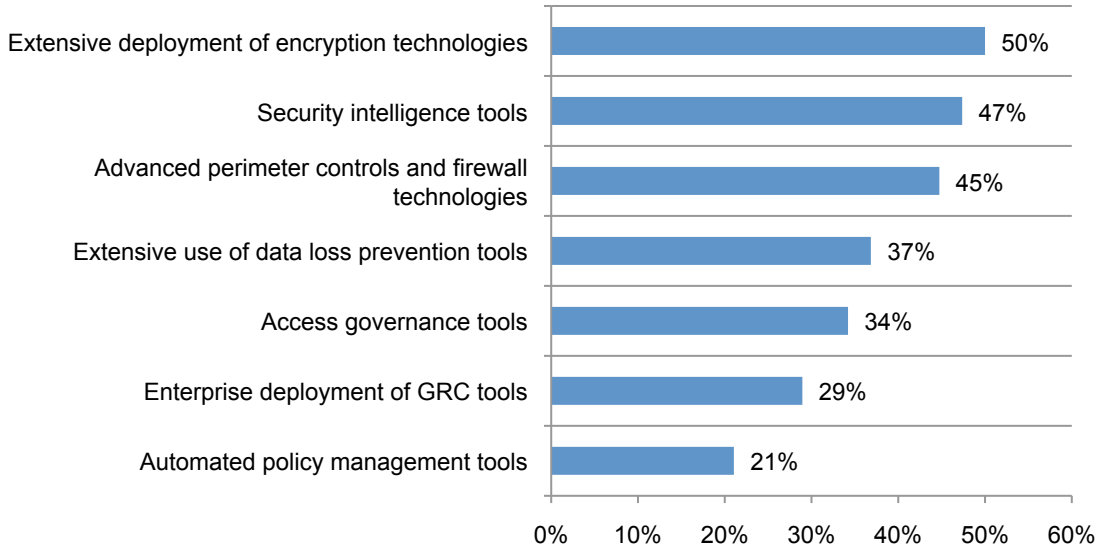


Figure 19 shows the incremental cost saving experienced by companies deploying each one of seven enabling security technologies. For example, companies deploying security intelligence systems, on average, experience a cost savings of £.59 million. Similarly, companies deploying access governance tools experience cost savings of £.64 million, on average. Please note that these cost savings are not additive.

Figure 19. Cost savings when deploying seven enabling security technologies

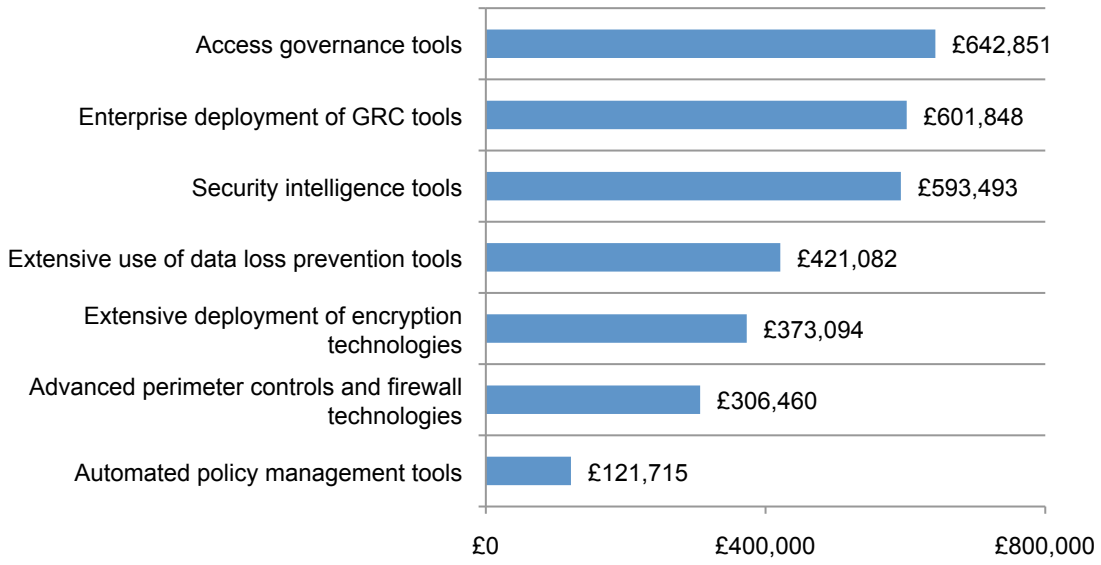
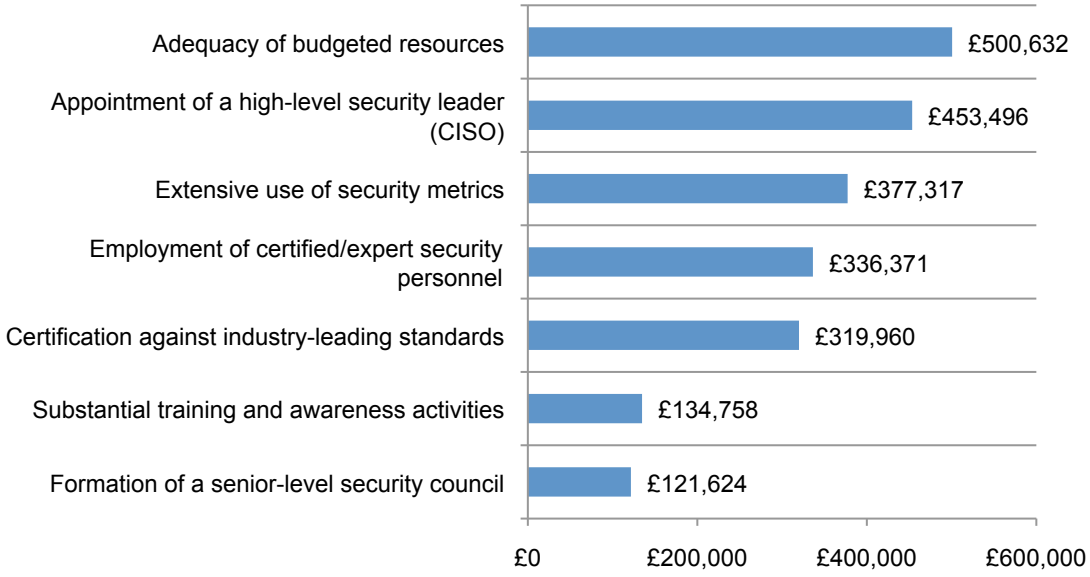


Figure 20 shows seven enterprise governance activities experienced by a subset of benchmarked companies. Each bar represents the percentage of companies fully executing each stated governance activity. The top three governance activities include: appointment of a high-level security leader (50 percent), certification against industry-leading standards (47 percent), and adequacy of budgeted resources (47 percent).

Figure 20. Seven enterprise security governance activities deployed

Figure 21 shows the incremental cost savings experienced by companies deploying each one of seven enterprise governance activities. As shown, companies obtaining sufficient budgeted resources enjoy an average cost savings of £.50 million. On average, companies appointing a high-level security leader experience cost savings of £.45 million. Similar to above, these estimated cost savings are not additive.

Figure 21. Cost savings when deploying seven enterprise governance activities



Part 4. Global Findings

Table 4 provides a summary of the total annualised cost of cyber crime for five countries (totaling 199 separate companies). As revealed, there is a significant variation among country samples in terms of total cost. The UK sample reports the lowest and the US sample reports the highest total cost of cyber crime (about a 2.75 X difference).

Table 4: Country analysis	Sample size	Local currency	US$
United States (US)	56	$8,933,510	$8,933,510
United Kingdom (UK)	38	£2,083,165	$3,252,912
Australia (AU)	33	$3,216,891	$3,386,201
Germany (DE)	43	4,840,320 €	$5,950,725
Japan (JP)	29	¥402,820,000	$5,154,447

Figure 22 examines in percentages five external costs or "consequences" of cyber crime for five countries. It clearly shows variation among countries, especially in two categories – that is, business disruption and information loss.

Information loss appears to be a more significant external cost for the US (at 44 percent) and German (40 percent) companies than for the UK (23 percent) and Australia (25 percent). In contrast, business disruption appears to be a more significant external cost for Australian (41 percent) and UK (38 percent) companies than for German (25 percent) and US (30 percent) companies. Finally, Japanese companies rate both business disruption and information loss equally at 36 percent.

Figure 22. Five external costs of cyber crime by country

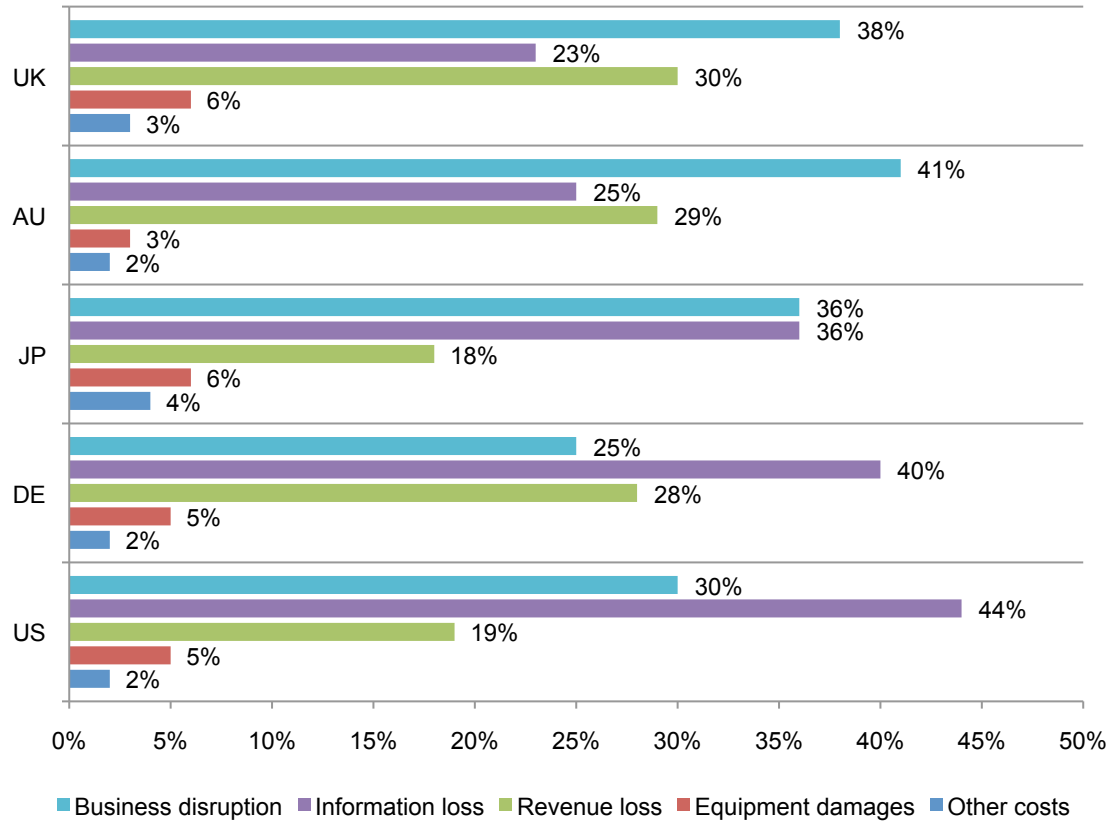


Figure 23 examines five internal or activity cost categories in percentage terms for five countries. It also shows variation among countries, especially in the detection and recovery cost categories. Recovery cost appears to be most significant for UK (35 percent) and Australian (33 percent) companies. Detection cost, appears to be most significant for German companies (33 percent). Finally, Japanese companies rate investigation (20 percent) and incident management (18 percent) at a higher percentage than other countries.

Figure 23. Five internal costs of cyber crime by country

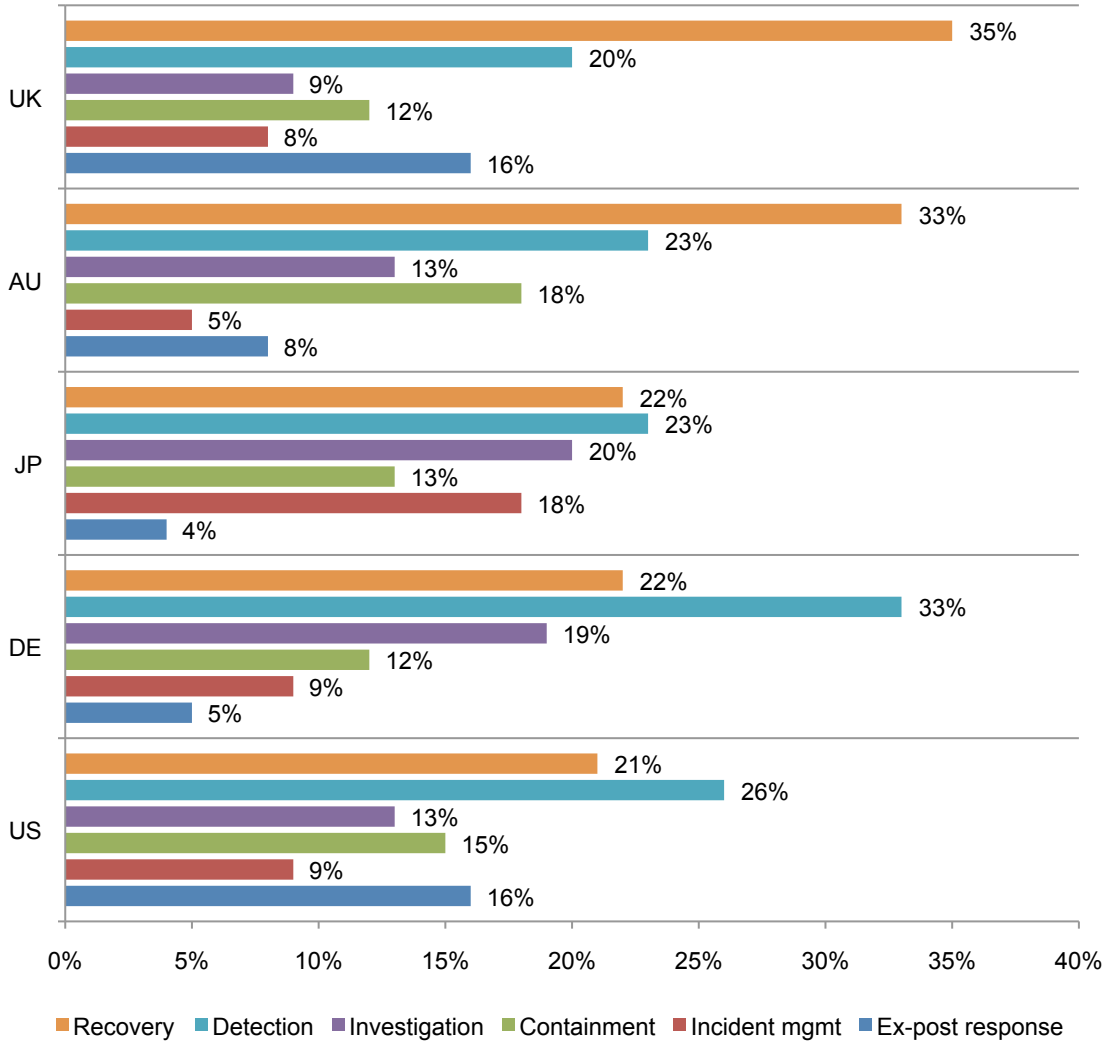


Figure 24 presents the consolidated number of cyber incidents examined within all five countries (including 199 separate companies). Our results show virus and malware are the most frequent attack vectors for participating organizations. While at a much lower incident frequency level, our research shows malicious insiders, malicious code, denial of services and web-based incidents are the most costly types of attacks experienced by companies in all countries.

Figure 24. Consolidated number of cyber incidents examined in five country samples
n = 199 separate companies

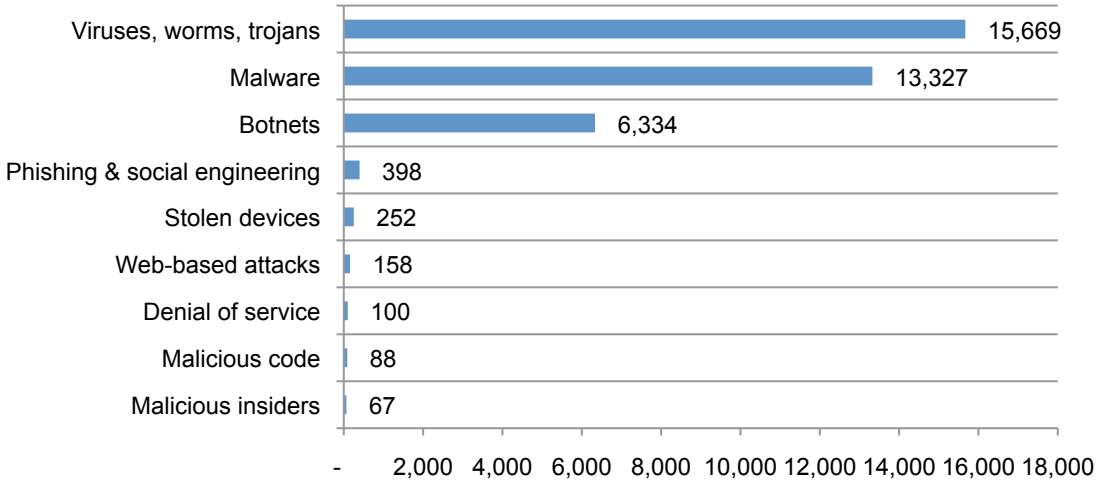
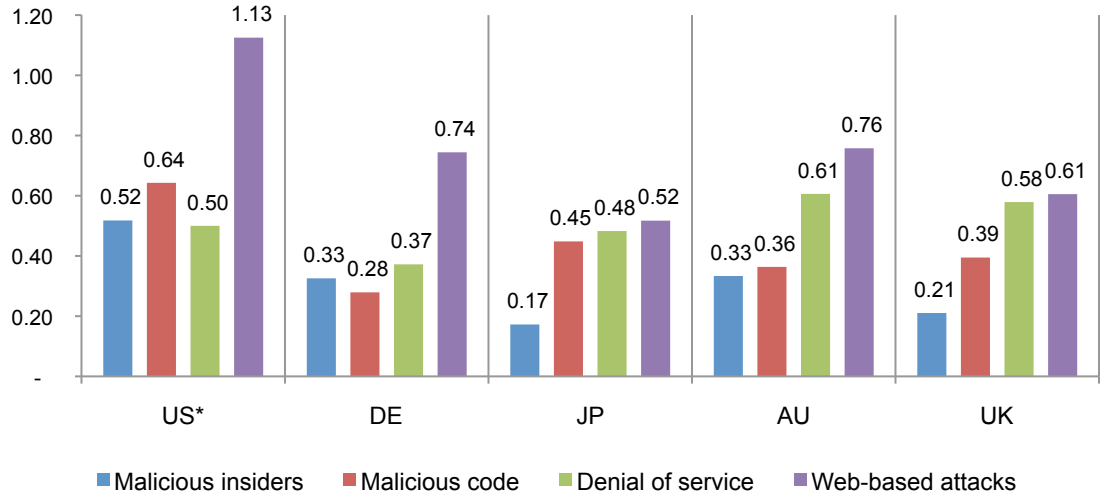


Figure 25 reports the attack frequency adjusted by sample size for the four most expensive types of cyber incidents. As can be seen, companies in the US sample were more likely to experience malicious insiders, malicious code and web-based incidents than other countries. UK and Australian companies appear to be more likely to experience denial of services. Japanese companies appear to be least likely to experience malicious insiders and web-based attacks. German companies are least likely to experience malicious code and denial services.

Figure 25. Adjusted frequency of four types of cyber attacks by country
Each bar shows the total frequency of the attack type divided by sample size
*The US sample shows that web-based attacks were observed more than once for some companies

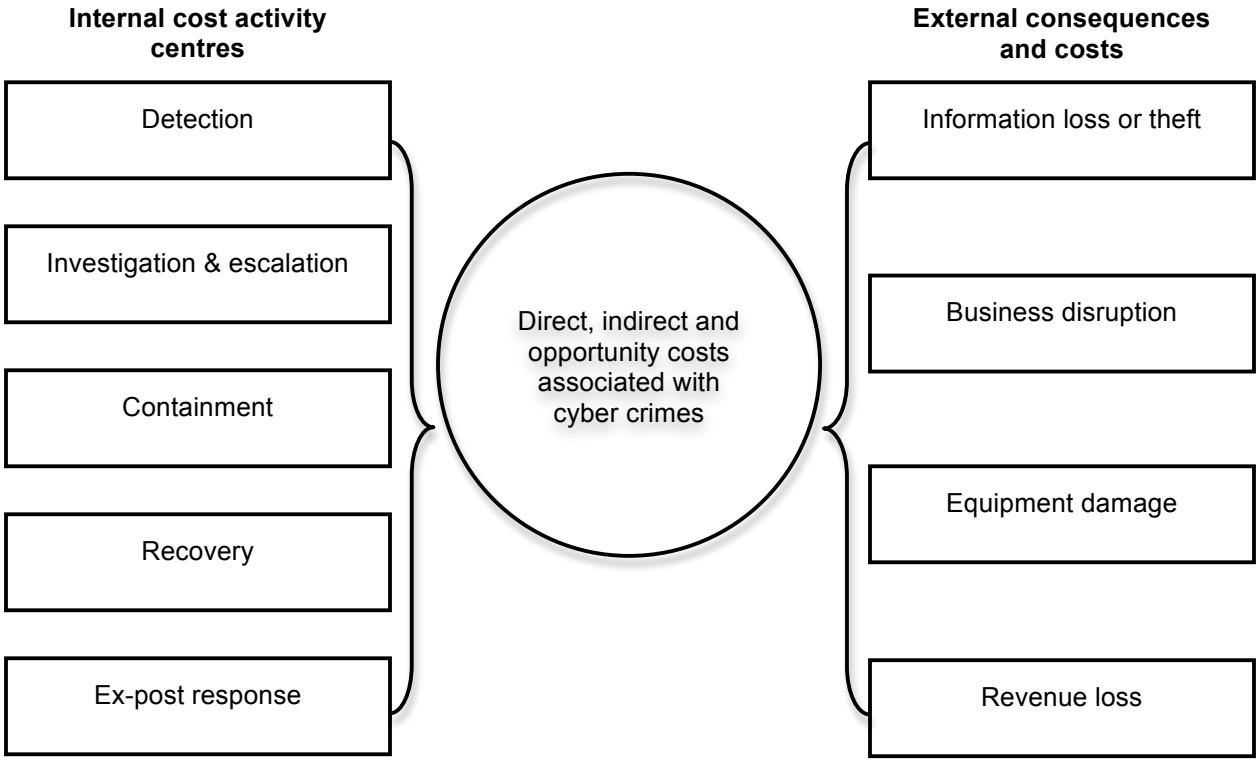


Part 5. Framework

Benchmark results of 38 organisations are intended to provide a meaningful baseline for companies experiencing a wide array of cyber attacks including viruses, malware, trojans, worms, malicious code, botnets, malicious insiders, denial of services and others.

The cost framework in Figure 26 presents the two separate cost streams used to measure the total cyber crime cost for each participating organisation. These two cost streams pertain to internal security-related activities and the external consequences experienced by organisations after experiencing an attack. Our benchmark methods attempt to elicit the actual experiences and consequences of cyber attacks. Our cost of cyber crime study is unique in addressing the core systems and business process-related activities that drive a range of expenditures associated with a company's response to cyber crime.

Figure 26
Cost Framework for Cyber Crime



This study addresses the core process-related activities that drive a range of expenditures associated with a company's cyber attack. The five internal cost activity centres in our framework include:[6]

- Detection: Activities that enable an organisation to reasonably detect and possibly deter cyber attacks or advanced threats. This includes allocated (overhead) costs of certain enabling technologies that enhance mitigation or early detection.

[6] Internal costs are extrapolated using labor (time) as a surrogate for direct and indirect costs. This is also used to allocate an overhead component for fixed costs such as multiyear investments in technologies.

- Investigation and escalation: Activities necessary to thoroughly uncover the source, scope, and magnitude of one or more incidents. The escalation activity also includes the steps taken to organise an initial management response.
- Containment: Activities that focus on stopping or lessening the severity of cyber attacks or advanced threats. These include shutting down high-risk attack vectors such as insecure applications or endpoints.
- Recovery: Activities associated with repairing and remediating the organisation's systems and core business processes. These include the restoration of damaged information assets and other IT (data centre) assets.
- Ex-post response: Activities to help the organisation minimize potential future attacks. These include adding new enabling technologies and control systems.

In addition to the above process-related activities, organisations often experience external consequences or costs associated with the aftermath of successful attacks – which are defined as attacks that infiltrate the organisation's network or enterprise systems. Accordingly, our Institute's research shows that four general cost activities associated with these external consequences are as follows:

- Cost of information loss or theft: Loss or theft of sensitive and confidential information as a result of a cyber attack. Such information includes trade secrets, intellectual properties (including source code), customer information and employee records. This cost category also includes the cost of data breach notification in the event that personal information is wrongfully acquired.
- Cost of business disruption: The economic impact of downtime or unplanned outages that prevent the organisation from meeting its data processing requirements.
- Cost of equipment damage: The cost to remediate equipment and other IT assets as a result of cyber attacks to information resources and critical infrastructure.
- Lost revenue: The loss of customers (churn) and other stakeholders because of system delays or shutdowns as a result of a cyber attack. To extrapolate this cost, we use a shadow costing method that relies on the "lifetime value" of an average customer as defined for each participating organisation.

While not specifically mentioned in Figure 26, the nature of attacks that underlie cost in our framework include the following attack types: viruses, worms, trojans; malware; botnets; web-based attacks; phishing and social engineering; malicious insiders (including stolen devices); malicious code (including SQL injection); and denial of services.[7]

[7] We acknowledge that these seven attack categories are not mutually independent and they do not represent an exhaustive list. Classification of a given attack was made by the researcher and derived from the facts collected during the benchmarking process.

Part 6. Benchmark Methods

The cost of cyber crime benchmark instrument is designed to collect descriptive information from IT, information security and other key individuals about the actual costs incurred either directly or indirectly as a result of cyber attacks actually detected. Our cost method does not require subjects to provide actual accounting results, but instead relies on estimation and extrapolation from interview data over a four-week period.

Cost estimation is based on confidential diagnostic interviews with key respondents within each benchmarked organisation. Table 5 reports the frequency of individuals by their approximate functional discipline that participated in this year's study. As can be seen, this year's study involved 354 individuals or an average of 9.32 interviews for each benchmarked company.

Table 5: Functional areas of interview respondents	Frequency
Data centre management	51
IT operations	50
IT security	48
Compliance	36
Network operations	33
Accounting & finance	19
Quality assurance	19
Physical security/facilities mgmt	18
Industrial control systems	16
Internal or IT audit	15
Human resources	15
Application development	13
Procurement/vendor mgmt	10
Legal	6
Other	5
Total	354
Interviews per company	9.32

Data collection methods did not include actual accounting information, but instead relied upon numerical estimation based on the knowledge and experience of each participant. Within each category, cost estimation was a two-stage process. First, the benchmark instrument required individuals to rate direct cost estimates for each cost category by marking a range variable defined in the following number line format.

How to use the number line: The number line provided under each data breach cost category is one way to obtain your best estimate for the sum of cash outlays, labor and overhead incurred. Please mark only one point somewhere between the lower and upper limits set above. You can reset the lower and upper limits of the number line at any time during the interview process.

Post your estimate of direct costs here for [presented cost category]

LL	_____|_____	UL

The numerical value obtained from the number line rather than a point estimate for each presented cost category preserved confidentiality and ensured a higher response rate. The benchmark instrument also required practitioners to provide a second estimate for indirect and opportunity costs, separately.

Cost estimates were then compiled for each organisation based on the relative magnitude of these costs in comparison to a direct cost within a given category. Finally, we administered general interview questions to obtain additional facts, including estimated revenue losses as a result of the cyber crime.

The size and scope of survey items was limited to known cost categories that cut across different industry sectors. In our experience, a survey focusing on process yields a higher response rate and better quality of results. We also used a paper instrument, rather than an electronic survey, to provide greater assurances of confidentiality.

Figure 26 (shown in Part 5) illustrates the activity-based costing schema we used in our benchmark study. As can be seen, we examined internal cost centres sequentially – starting with incident discovery to escalation to containment to recovery to ex-post response and culminating in diminished business opportunities or revenues. The cost driver of ex-post response and lost business opportunities is business disruption resulting from the attack.

In total, the benchmark instrument contained descriptive costs for each one of the five cost activity centres. Within each cost activity centre, the survey required respondents to estimate the cost range to signify direct cost, indirect cost and opportunity cost, defined as follows:

- Direct cost – the direct expense outlay to accomplish a given activity.
- Indirect cost – the amount of time, effort and other organisational resources spent, but not as a direct cash outlay.
- Opportunity cost – the cost resulting from lost business opportunities as a consequence of reputation diminishment after the incident.

To maintain complete confidentiality, the survey instrument did not capture company-specific information of any kind. Subject materials contained no tracking codes or other methods that could link responses to participating companies.

To keep the benchmark instrument to a manageable size, we carefully limited items to only those cost activities we considered crucial to the measurement of cyber crime cost. Based on discussions with learned experts, the final set of items focused on a finite set of direct or indirect cost activities. After collecting benchmark information, each instrument was examined carefully for consistency and completeness. In this study, a few companies were rejected because of incomplete, inconsistent or blank responses.

Utilizing activity-based costing (ABC), cost estimates were captured using a standardized instrument for direct and indirect cost categories. Specifically, labor (productivity) and overhead costs were allocated to five internal activity centres (see Figure 13). External costs, including the loss of information assets, business disruption, equipment damage and revenue loss, were captured using shadow-costing methods. Total costs were allocated to eight discernible attack vectors.

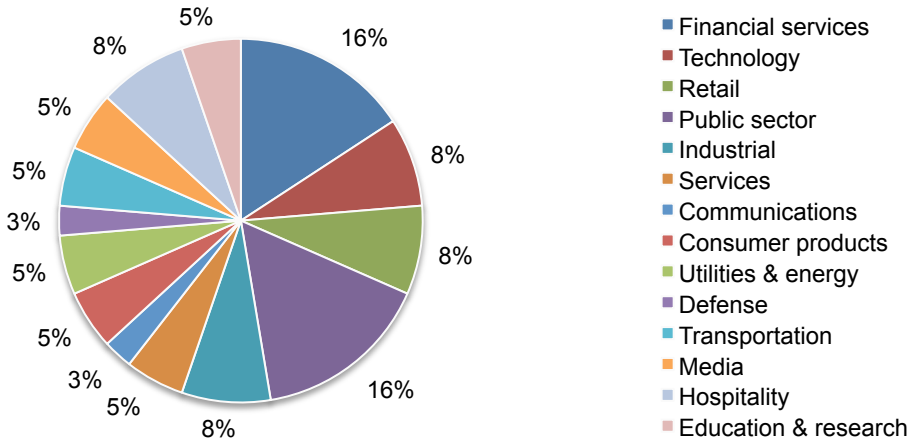
Field research was conducted over a seven-month period concluding in August 2012. To maintain consistency across all benchmark companies, information collected above each of these organizations' cyber crime experience was limited to four consecutive weeks. The four consecutive weeks for any given organisation was not necessarily the same time period as every other organisation is this study. The extrapolated direct, indirect and opportunity costs of cyber crime were annualised by dividing the total cost collected over four weeks (ratio = 4/52 weeks).

Part 7. Benchmark Sample

The present study was launched in January 2012. The recruitment started with a personalized letter and a follow-up phone call to 543 UK.-based organisations for possible participation in our study.[8] While 49 organisations initially agreed to participate, 38 organisations permitted our researchers to complete the benchmark analysis.

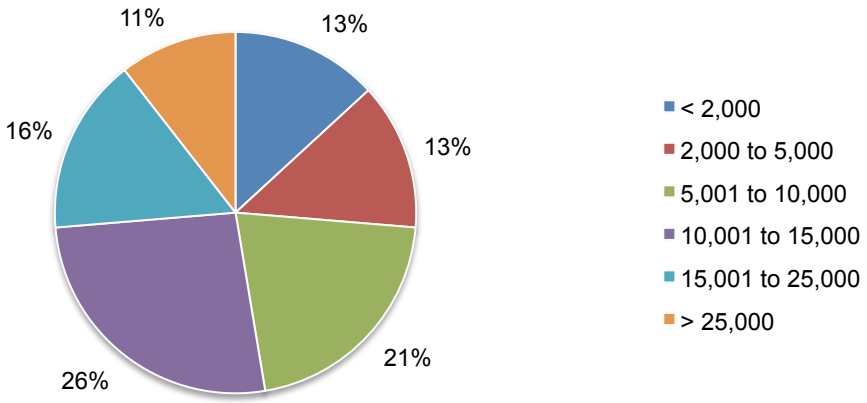
Pie Chart 1 summarizes the current (FY 2012) sample of participating companies based on 14 primary industry classifications. As can be seen, both financial services and technology (16 percent) represent the largest segments. Financial services include retail banking, insurance, brokerage and credit card companies. The technology segment represents organisations in software and IT management.

Pie Chart 1. Industry sectors of participating organisations



Pie Chart 2 reports the percentage frequency of companies based on the number of enterprise seats connected to networks or systems. Our analysis of cyber crime cost only pertains to organisations with 1,009 to 95,600 enterprise seats.

Pie Chart 2. Distribution of participating organisations by enterprise seats (size)



[8]Approximately, half of the organisations contacted for possible participation in this year's study are members of Ponemon Institute's benchmarking community. This community of companies is composed of organisations that have participated in one or more benchmarking studies sometime over the past nine years.

Part 8. Limitations & Conclusions

This study utilizes a confidential and proprietary benchmark method that has been successfully deployed in earlier Ponemon Institute research. However, there are inherent limitations to benchmark research that need to be carefully considered before drawing conclusions from findings.

- Non-statistical results: The purpose of this study is descriptive rather than normative inference. The current study draws upon a representative, non-statistical sample of organisations, all UK-based entities experiencing one or more cyber attacks during a four-week fielding period. Statistical inferences, margins of error and confidence intervals cannot be applied to these data given the nature of our sampling plan.

- Non-response: The current findings are based on a small representative sample of completed case studies. An initial mailing of benchmark surveys was sent to a targeted group of 543 separate organisations, all believed to have experienced one or more cyber attacks. Thirty-eight companies provided usable benchmark surveys. Non-response bias was not tested so it is always possible companies that did not participate are substantially different in terms of the methods used to manage the cyber crime containment and recovery process, as well as the underlying costs involved.

- Sampling-frame bias: Because our sampling frame is judgmental, the quality of results is influenced by the degree to which the frame is representative of the population of companies being studied. It is our belief that the current sampling frame is biased toward companies with more mature information security programs.

- Company-specific information: The benchmark information is sensitive and confidential. Thus, the current instrument does not capture company-identifying information. It also allows individuals to use categorical response variables to disclose demographic information about the company and industry category. Industry classification relies on self-reported results.

- Unmeasured factors: To keep the survey concise and focused, we decided to omit other important variables from our analyses such as leading trends and organisational characteristics. The extent to which omitted variables might explain benchmark results cannot be estimated at this time.

- Estimated cost results. The quality of survey research is based on the integrity of confidential responses received from companies. While certain checks and balances can be incorporated into the survey process, there is always the possibility that respondents did not provide truthful responses. In addition, the use of a cost estimation technique (termed shadow costing methods) rather than actual cost data could create significant bias in presented results.

Report Conclusions

The findings of our first UK study on the cost of cyber crime provide evidence that companies expend considerable time and resources responding to a plethora of different types of attacks. As in prior years, the most significant costs result from the theft or misuse of information assets. Our findings also suggest that the cost of cyber crime is on the rise.

On a positive note, we found that the cost of any given attack can be substantially reduced by deploying certain security technologies and by advancing good governance practices throughout the company. Finally, despite its stated limitations, this research is encouraging to those who believe in the proposition that good security practices have a positive return on investment.

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