2017

COST OF CYBER CRIME STUDY

INSIGHTS ON THE SECURITY INVESTMENTS THAT MAKE A DIFFERENCE

Ponemon INSTITUTE

Independently conducted by Ponemon Institute LLC
and jointly developed by Accenture

EXECUTIVE SUMMARY

Average annualized cost of cybersecurity (USD)

$11.7M

Percentage increase in cost of cybersecurity in a year

22.7%

Average number of security breaches each year

130

Percentage increase in average annual number of security breaches

27.4%

PRIORITIZING BREAKTHROUGH INVESTMENTS

Over the last two years, the accelerating cost of cyber crime means that it is now 23 percent more than last year and is costing organizations, on average, US$11.7 million. Whether managing incidents themselves or spending to recover from the disruption to the business and customers, organizations are investing on an unprecedented scale—but current spending priorities show that much of this is misdirected toward security capabilities that fail to deliver the greatest efficiency and effectiveness.

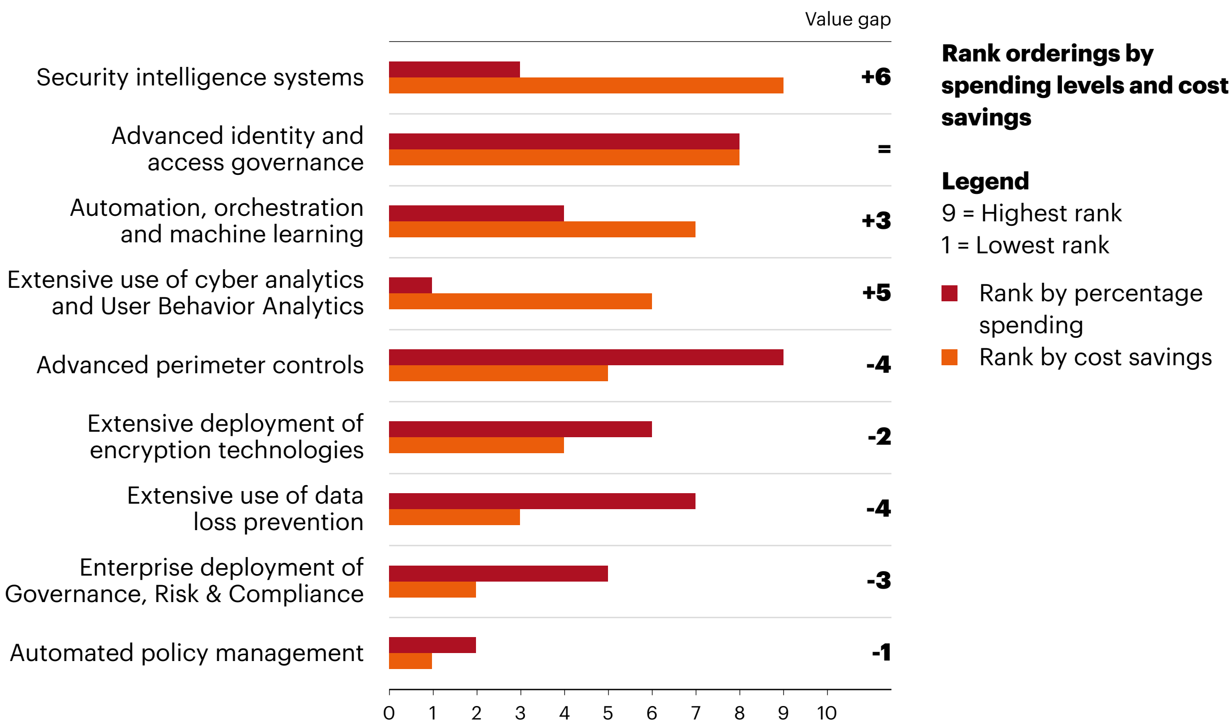
A better understanding of the cost of cyber crime could help executives bridge the gap between their own defenses and the escalating creativity—and numbers—of threat actors. Alongside the increased cost of cyber crime—which runs into an average of more than US$17 million for organizations in industries like Financial Services and Utilities and Energy—attackers are getting smarter. Criminals are evolving new business models, such as ransomware-as-a-service, which mean that attackers are finding it easier to scale cyber crime globally.

EXECUTIVE SUMMARY

With cyber attacks on the rise, successful breaches per company each year has risen more than 27 percent, from an average of 102 to 130. Ransomware attacks alone have doubled in frequency, from 13 percent to 27 percent, with incidents like WannaCry and Petya affecting thousands of targets and disrupting public services and large corporations across the world. One of the most significant data breaches in recent years has been the successful theft of 143 million customer records from Equifax—a consumer credit reporting agency—a cyber crime with devastating consequences due to the type of personally identifiable information stolen and knock-on effect on the credit markets. Information theft of this type remains the most expensive consequence of a cyber crime. Among the organizations we studied, information loss represents the largest cost component with a rise from 35 percent in 2015 to 43 percent in 2017. It is this threat landscape that demands organizations re-examine their investment priorities to keep pace with these more sophisticated and highly motivated attacks.

To better understand the effectiveness of investment decisions, we analyzed nine security technologies across two dimensions: the percentage spending level between them and their value in terms of cost-savings to the business. The findings illustrate that many organizations may be spending too much on the wrong technologies. Five of the nine security technologies had a negative value gap where the percentage spending level is higher than the relative value to the business. Of the remaining four technologies, three had a significant positive value gap and one was in balance. So, while maintaining the status quo on advanced identity and access governance, the opportunity exists to evaluate potential over-spend in areas which have a negative value gap and rebalance these funds by investing in the breakthrough innovations which deliver positive value.

THE POSITIVE OR NEGATIVE VALUE GAPS ASSOCIATED WITH SECURITY INVESTMENTS



Following on from the first *Cost of Cyber Crime*[1] report launched in the United States eight years ago, this study, undertaken by the Ponemon Institute and jointly developed by Accenture, evaluated the responses of 2,182 interviews from 254 companies in seven countries—Australia, France, Germany, Italy, Japan, United Kingdom and the United States. We aimed to quantify the economic impact of cyber attacks and observe cost trends over time to offer some practical guidance on how organizations can stay ahead of growing cyber threats.

1: The study examines the total costs organizations incur when responding to cyber crime incidents. These include the costs to detect, recover, investigate and manage the incident response. Also covered are the costs that result in after-the-fact activities and efforts to contain additional costs from business disruption and the loss of customers. These costs do not include the plethora of expenditures and investments made to sustain an organization's security posture or compliance with standards, policies and regulations.

HIGHLIGHTS FROM THE FINDINGS INCLUDE:

Organizations need to better balance investments in security technologies.

Security intelligence systems (67 percent) and advanced identity and access governance (63 percent) are the top two most widely deployed enabling security technologies across the enterprise. They also deliver the highest positive value gap with organizational cost savings of US$2.8 million and US$2.4 million respectively. As the threat landscape constantly evolves, these investments should be monitored closely so that spend is at an appropriate level and maintains effective outcomes. Aside from systems and governance, other investments show a lack of balance. Of the nine security technologies evaluated, the highest percentage spend was on advanced perimeter controls. Yet, the cost savings associated with technologies in this area were only fifth in the overall ranking with a negative value gap of minus 4. Clearly, an opportunity exists here to assess spending levels and potentially reallocate investments to higher-value security technologies.

Compliance technology is important but don't bet the business on it.

Spending on governance, risk and compliance (GRC) technologies is not a fast-track to increased security. Enterprise-wide deployment of GRC technology and automated policy management showed the lowest effectiveness in reducing cyber crime costs (9 percent and 7 percent respectively) out of nine enabling security technologies. So, while compliance technology is important, organizations must spend to a level that is appropriate to achieve the required capability and effectiveness, enabling them to free up funds for breakthrough innovations.

Organizations need to grasp the innovation opportunity.

Innovations are generating the highest returns on investment, yet investment in them is low. For example, two enabling security technology areas identified as "Extensive use of cyber analytics and User Behavior Analytics (UBA)" and "Automation, orchestration and machine learning" were the lowest ranked technologies for enterprise-wide deployment (32 percent and 28 percent respectively) and yet they provide the third and fourth highest cost savings for security technologies. By balancing investments from less rewarding technologies into these breakthrough innovation areas, organizations could improve the effectiveness of their security programs.

RECOMMENDATIONS

$2.8M cost savings from security intelligence systems and most positive value gap

The foundation of a strong and effective security program is to identify and "harden" the higher-value assets. These are the "crown jewels" of a business—the assets most critical to operations, subject to the most stringent regulatory penalties, and the source of important trade secrets and market differentiation. Hardening these assets makes it as difficult and costly as possible for adversaries to achieve their goals, and limits the damage they can cause if they do obtain access.

By taking the following three steps, organizations can further improve the effectiveness of their cybersecurity efforts to fend off and reduce the impact of cyber crime:

1 > Build cyber-security on a strong foundation

Invest in the "brilliant basics" such as security intelligence and advanced access management and yet recognize the need to innovate to stay ahead of the hackers.

2 > Undertake extreme pressure testing

Organizations should not rely on compliance alone to enhance their security profile but undertake extreme pressure testing to identify vulnerabilities more rigorously than even the most highly motivated attacker.

3 > Invest in breakthrough innovation

Balance spend on new technologies, specifically analytics and artificial intelligence, to enhance program effectiveness and scale value.

Organizations need to recognize that spending alone does not always equate to value. Beyond prevention and remediation, if security fails, companies face unexpected costs from not being able to run their businesses efficiently to compete in the digital economy. Knowing which assets must be protected, and what the consequences will be for the business if protection fails, requires an intelligent security strategy that builds resilience from the inside out and an industry-specific strategy that protects the entire value chain. As this research shows, making wise security investments can help to make a difference.

$2.4 million average cost of malware attack spend and the top cost to companies

50 days average time to resolve a malicious insiders attack

23 days average time to resolve a ransomware attack

KEY FINDINGS

The average total cost by country, organizational size and industry

The financial consequence of a cyber attack is worsening. **P12**

The cost of cyber crime varies by organizational size. **P17**

Financial services has the highest cost of cyber crime. **P20**

The cost of cyber crime by type of attack

Certain attacks are more costly based on organizational size. **P21**

Ransomware attacks have doubled. **P23**

Country costs vary considerably by the type of cyber attack. **P24**

Costs vary significantly among countries. **P25**

The cost of cyber crime is also influenced by the frequency of attacks. **P26**

Malware and Web-based attacks are the two most costly attack types. **P27**

Malicious code attacks are taking longer to resolve and, as a result, are more costly. **P28**

Analysis of the costs to resolve the consequences of the cyber attack

Information theft remains the most expensive consequence of a cyber crime. **P29**

Companies spend the most on detection and recovery. **P30**

How companies allocate resources and achieve cost savings

Budget allocations are slowly shifting from the network to application and data layers. **P32**

Security intelligence systems have the biggest return on investment. **P35**

Maturity and effectiveness of an organization's security posture

Program maturity is weighted toward the middle stages. **P37**

Findings reveal a non-linear relationship between total cost of cyber crime and maturity stage of the cybersecurity program. **P38**

Two countries have a negative security effectiveness score. **P39**

The findings reveal a high SES decreases the total cost of cyber crime. **P40**

More investment is needed in breakthrough technologies. **P41**

The cost of cyber crime varies by country, organizational size, industry, type of cyber attack and maturity and effectiveness of an organization's security posture. In addition to presenting the range of costs according to these variables, we also analyzed the average expenditures and allocation of resources to resolve the cyber attack. Topics covered in this report include:

- Average total cost by country, organizational size and industry
- The cost of cyber crime by type of cyber attack
- Analysis of the costs to resolve the consequences of the cyber attack
- How companies allocate resources and achieve cost savings
- Maturity and effectiveness of an organization's security posture

The average total cost by country, organizational size and industry

KEY FINDING 1

The financial consequence of a cyber attack is worsening.

Figure 1 presents the global average cost of cyber crime over the last five years. After a steady increase for the first three years, the significant increase we uncovered last year has continued with an increase of 27.4 percent in the last year alone.

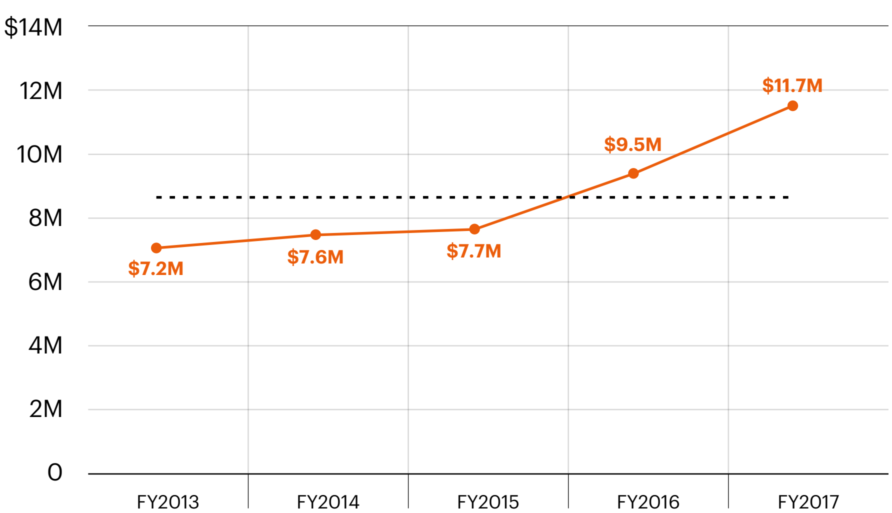


FIGURE 1
The global average cost of cyber crime over five years
US dollars

Legend
Consolidated view
n = 254 separate companies

Total average cost
Five-year average

Percentage change in average cost over five years is 62 percent

Figure 2 presents the estimated average cost of cyber crime for seven countries, involving 254 separate companies, for the past three years. Companies in the United States report the highest total average cost at US$21 million and Australia reports the lowest total average cost at US$5.41 million.

To determine the average cost of cyber crime, the 254 organizations in the study were asked to report what they spent to deal with cyber crimes experienced over four consecutive weeks. Once costs over the four-week period were compiled and validated, these figures were then grossed-up to determine the annualized cost.[2]

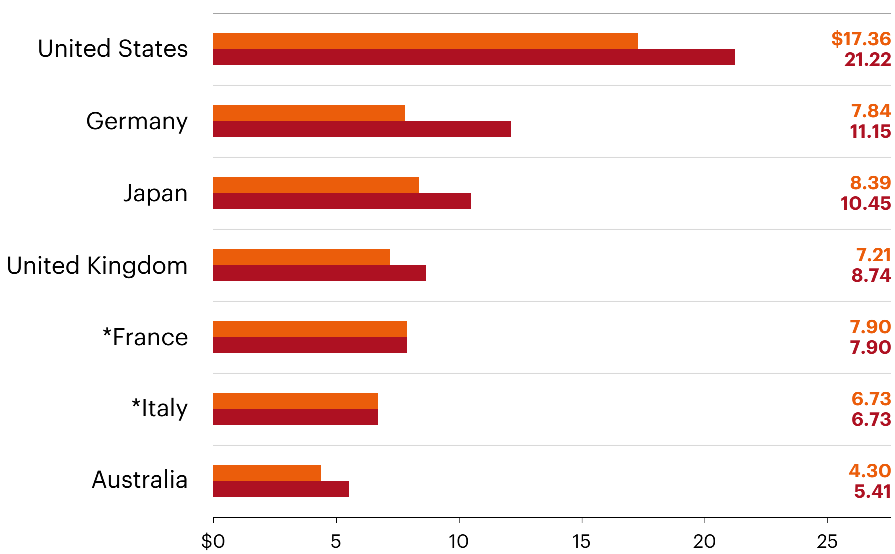


FIGURE 2
Total cost of cyber crime in seven countries
*Historical data does not exist for newly added country samples

Legend
US$ millions
n = 254

- FY2016 (US$ millions)
- FY 2017 (US$ millions)

2: Following is the gross-up statistic: Annualized revenue = [cost estimate]/[4/52 weeks].

KEY FINDINGS

Figure 3 summarizes the percentage increase in cyber crime costs between 2016 and 2017 as measured by the US dollar. As shown, Germany experienced the most significant increase in total cyber crime cost and the United Kingdom had the lowest change.

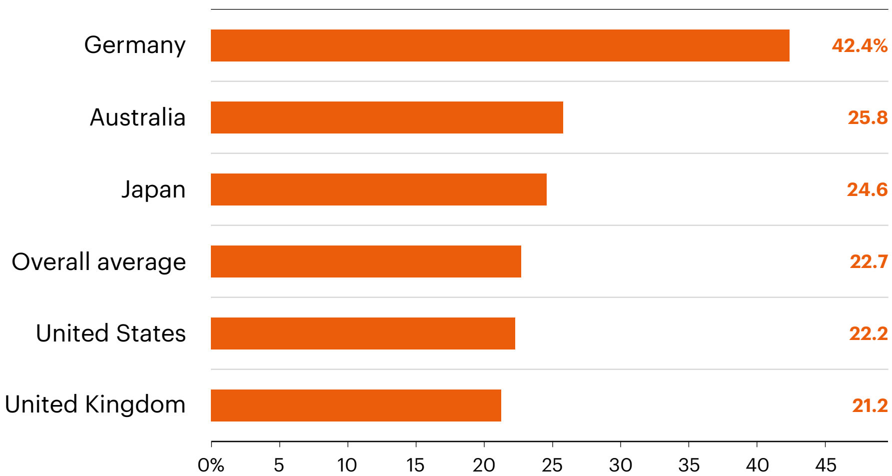


FIGURE 3
One-year percentage increase in cyber crime by country sample
Percentage increase could not be calculated for France and Italy as they were included for the first time in this report

Legend
Mean = 20.4%
n = 254 companies

Figure 4 reports the distribution of annualized total cost for 254 companies. As can be seen, 90 companies in our sample incurred total costs above the mean value of US$11.7 million, indicating a skewed distribution. The highest cost estimate of US$77.1 million was determined not to be an outlier based on additional analysis. A total of 163 organizations experienced an annualized total cost of cyber crime below the mean value.

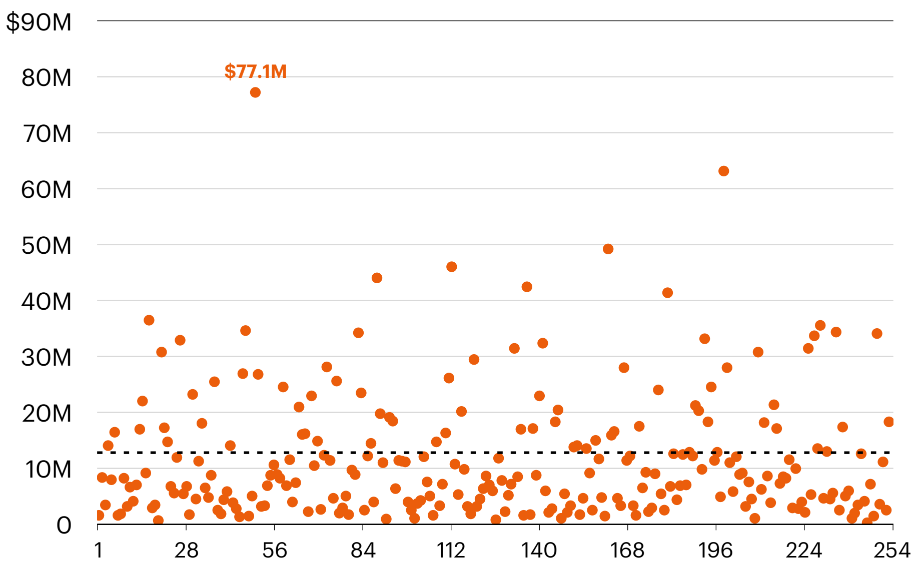


FIGURE 4

Scattergram of total cost of cyber crime for 254 participating companies

Cost expressed in US$

Legend

2017 Average total cost

2017 Annualized total cost

KEY FINDINGS

As part of our analysis we calculated a precision interval for the average cost of US$11.7 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 5. Specifically, at a 90 percent level of confidence we expect the range of cost to be between US$11 million to US$12.3 million.

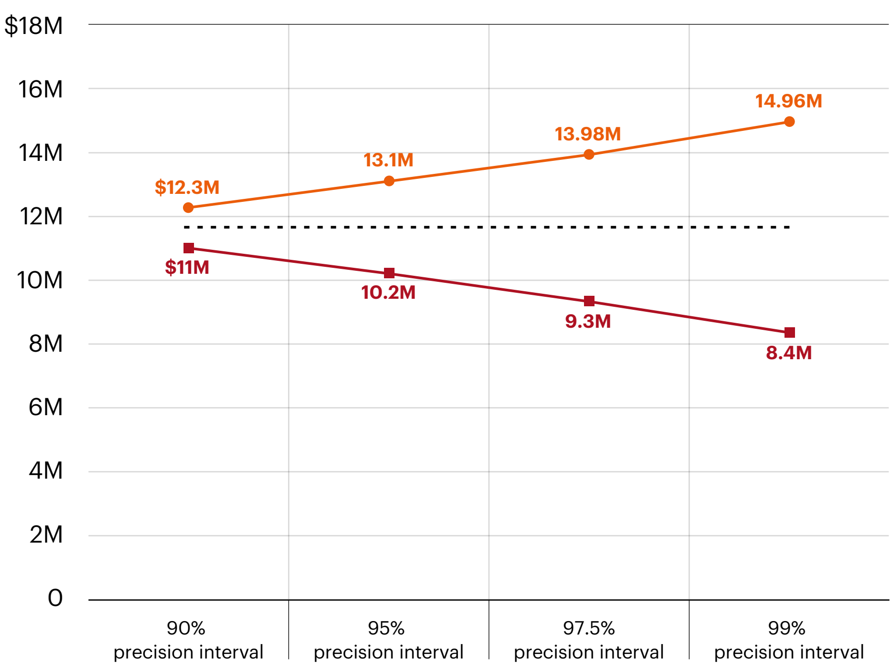


FIGURE 5
Precision interval for the mean value of annualized total cost
Cost expressed in US$

Legend
- Minimum
- Mean
- Maximum

KEY FINDING 2

The cost of cyber crime varies by organizational size.

As shown in Figure 6, organizational size, as measured by the number of enterprise seats or nodes, is positively correlated to annualized cyber crime cost. This positive correlation is indicated by the upward sloping regression line. The number of seats ranges from a low of 1,050 to a high of 259,000.

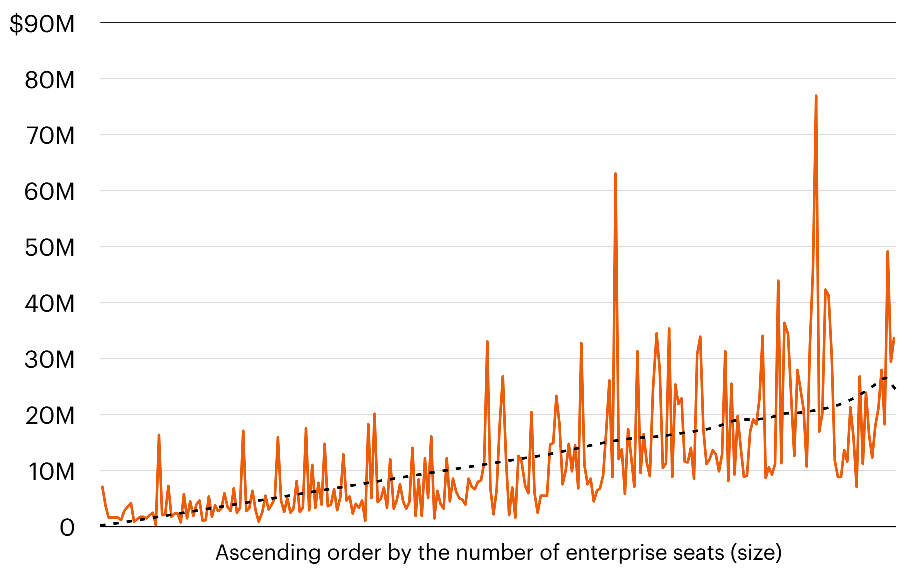


FIGURE 6

Annualized cost in ascending order by the number of enterprise seats

Cost expressed in US$

Legend

— 2017 Annualized total cost

--- Regression

KEY FINDINGS

Organizations are placed into one of four quartiles based on their total number of enterprise seats[3] (which we use as a size surrogate). We do this to create a more precise understanding of the relationship between organizational size and the cost of cyber crime. Table 1 shows the quartile average cost of cyber crime for five years. Approximately 64 companies are in each quartile.

TABLE 1
The quartile average cost of cyber crime over five years

TABLE 1 Quartile analysis	**FY 2017**	**FY 2016**	**FY 2015**	**FY 2014**	**FY 2013**
Cost expressed in US$	(n=254)	(n=237)	(n=252)	(n=257)	(n=234)
Quartile 1 (smallest)	$3,556,300	$3,477,633	$3,279,376	$2,967,723	$2,965,464
Quartile 2	$5,685,633	$5,567,110	$5,246,519	$5,107,532	$4,453,688
Quartile 3	$10,125,414	$9,854,250	$8,987,450	$8,321,024	$6,659,478
Quartile 4 (largest)	$16,852,250	$14,589,120	$13,372,861	$13,805,529	$14,707,980

3: Enterprise seats refer to the number of direct connections to the network and enterprise systems.

Table 2 reports the average cost per enterprise seat (also known as the per capita cost) compiled for four quartiles ranging from the smallest (Quartile 1) to the largest (Quartile 4). Consistent with prior years, the 2017 average per capita cost for organizations with the fewest seats is approximately four times higher than the average per capita cost for organizations with the most seats (US$1,726 versus US$436).

TABLE 2
The average cost per enterprise seat

TABLE 2 **Quartile analysis**	**2017 cost/seat**	**2016 cost/seat**	**2015 cost/seat**	**2014 cost/seat**	**2013 cost/seat**
Cost expressed in US$	(n=254)	(n=237)	(n=252)	(n=257)	(n=234)
Quartile 1 (smallest)	$1,726	$1,688	$1,555	$1,601	$1,388
Quartile 2	$975	$952	$878	$962	$710
Quartile 3	$655	$698	$709	$726	$532
Quartile 4 (largest)	$436	$401	$368	$437	$431

KEY FINDING 3

Financial services has the highest cost of cyber crime.

The average annualized cost of cyber crime varies by industry segment. In this year's study we compare cost averages for 15 different industry sectors. As shown in Figure 7, the cost of cyber crime for companies in financial services and utilities and energy have the highest annualized cost. In contrast, companies in life science, education and hospitality incurred a much lower cost on average.[4]

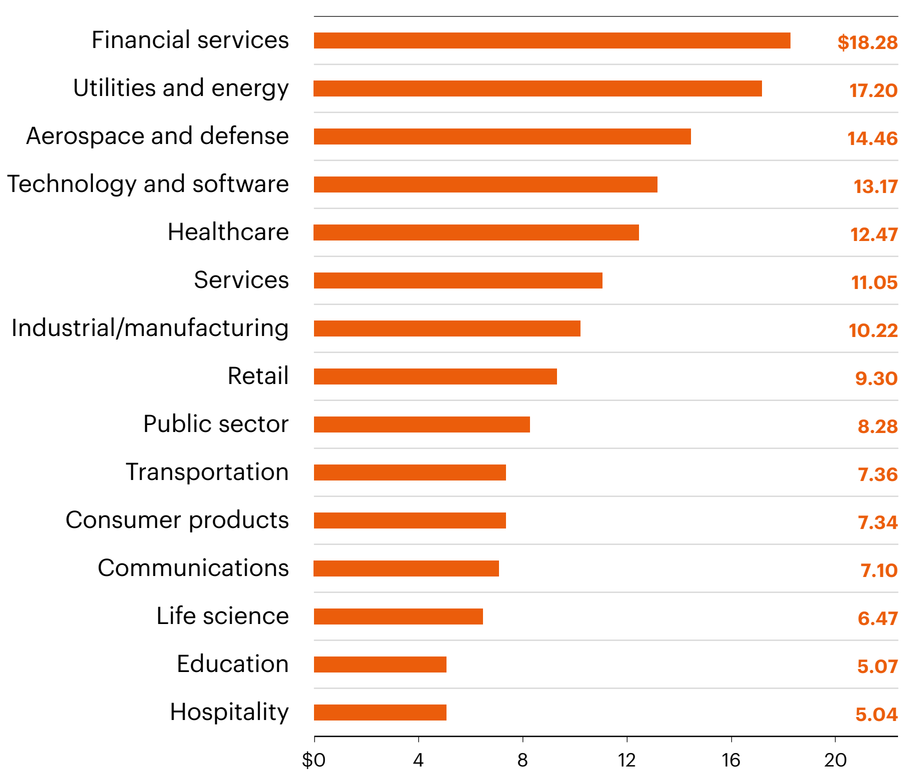


FIGURE 7
Average annualized cost by industry sector
US$ millions

Legend
Consolidated view
n = 254 companies

Total annualized cost ($1 million omitted)

4: This analysis is for illustration purposes only. The sample sizes in several sectors are too small to make definitive conclusions about industry differences.

The cost of cyber crime by type of attack

KEY FINDING 4

Certain attacks are more costly based on organizational size.

The study focuses on nine different attack vectors as the source of the cyber crime. In Figure 8, we compare smaller and larger-sized organizations based on the sample median of 8,560 seats.

Smaller organizations (below the median) experience a higher proportion of cyber crime costs relating to malware, Web-based attacks, phishing and social engineering attacks and stolen devices. In contrast, larger organizations (above the median) experience a higher proportion of costs relating to denial of services, malicious insiders and malicious code.

In the context of this research, malicious insiders include employees, temporary employees, contractors and, possibly other business partners. We also distinguish viruses from malware. Viruses reside on the endpoint and as yet have not infiltrated the network but malware has infiltrated the network. Malicious code attacks the application layer and includes SQL attack.

KEY FINDINGS

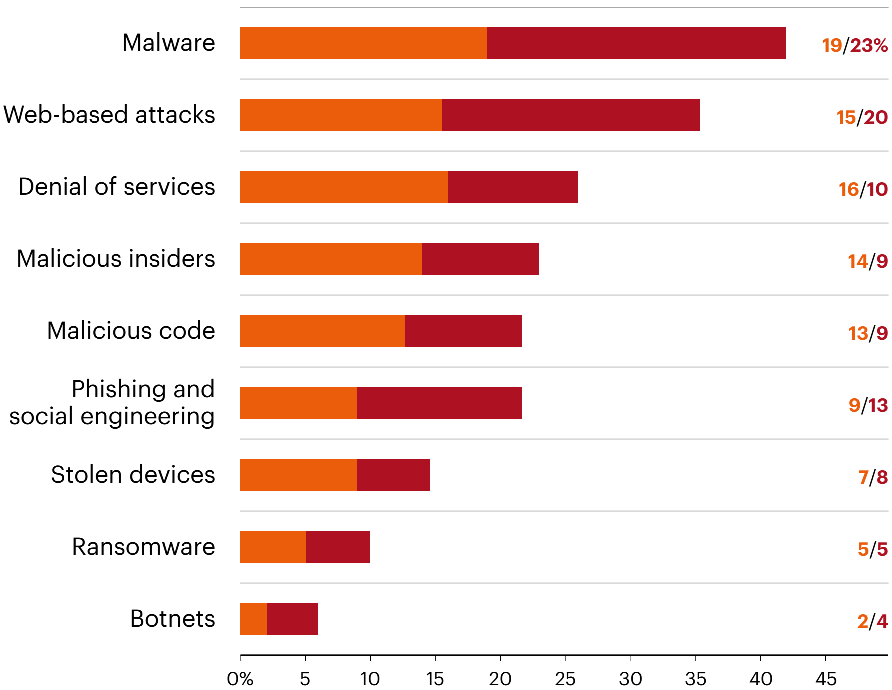


FIGURE 8
Organizational size affects the cost of nine attack types
Size measured according to the number of enterprise seats within the participating organizations

Legend
Consolidated view
n = 254 companies

- Above median number of enterprise seats
- Below median number of enterprise seats

This year, the benchmark sample of 254 organizations experienced a total of 635 discernible cyber attacks. Table 3 shows the number of successful attacks for the past six years, which has steadily increased.

TABLE 3
Frequency of discernible cyber attacks over six years

Year of study	Sample size	Total number of attacks	Successful attacks per company each week
FY 2017	254	635	2.5
FY 2016	237	465	2.0
FY 2015	252	477	1.9
FY 2014	257	429	1.7
FY 2013	234	343	1.4
FY 2012	199	262	1.3

KEY FINDING 5

Ransomware attacks have doubled.

Figure 9 summarizes in percentages the types of attack methods experienced by participating companies. As shown, ransomware attacks increased significantly from 13 percent to 27 percent since last year.

Virtually all organizations had attacks relating to viruses, worms and/or trojans and malware over the four-week benchmark period. Malware attacks and malicious code attacks are inextricably linked. We classified malware attacks that successfully infiltrated the organizations' networks or enterprise systems as a malicious code attack. Sixty-nine percent of companies experienced phishing and social engineering and 67 percent of companies had Web-based attacks.

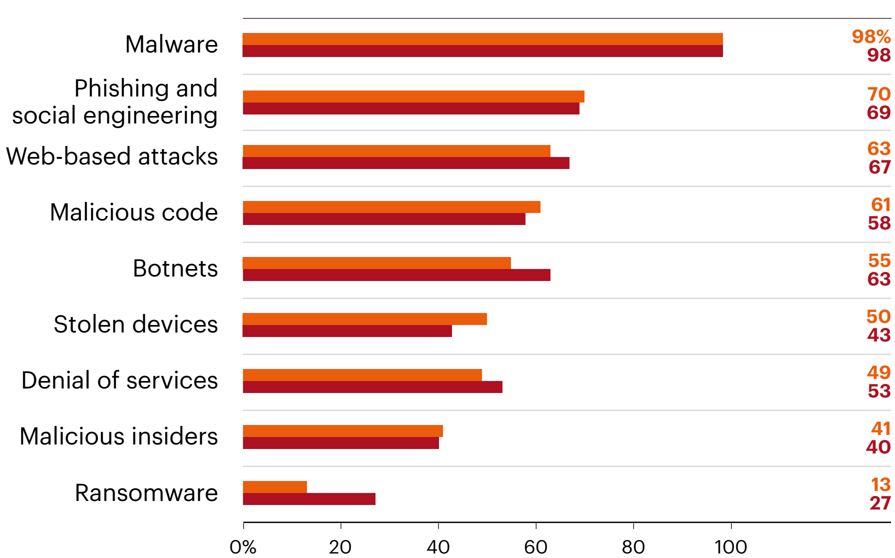


FIGURE 9
Types of cyber attacks experienced by companies

Legend
Consolidated view
n = 254 companies

FY 2016
FY 2017

KEY FINDING 6

Country costs vary considerably by the type of cyber attack.

Figure 10 compares benchmark results for seven countries, showing the percentage of annualized cost of cyber crime allocated to nine attack types compiled from all benchmarked organizations. Germany and Australia have the most costly malware attacks (both 23 percent), France has the most costly Web-based attacks (20 percent) and Germany and the United Kingdom have the most costly denial of service attacks (both 15 percent).

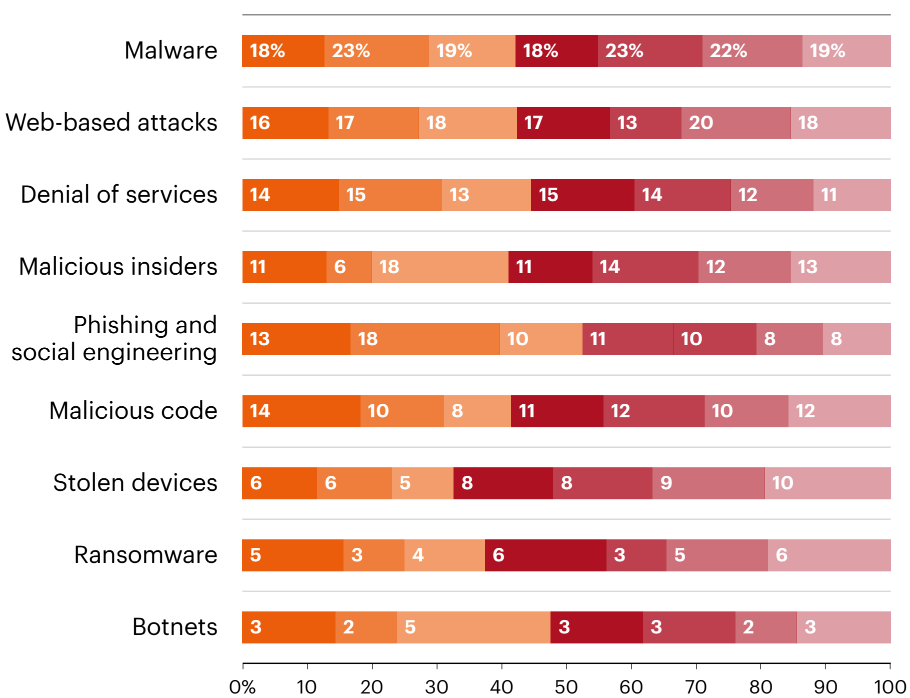


FIGURE 10
Percentage annualized cyber crime cost by attack type and country

Legend
Consolidated view
n = 254 companies

- United States
- Germany
- Japan
- United Kingdom
- Australia
- France
- Italy

KEY FINDING 7

Costs vary significantly among countries.

As shown in Figure 11, United States companies are paying more to resolve all types of cyber attack, especially for malware and Web-based attacks (US$3.82 million and US$3.40 million per attack, respectively). The least expensive attack type for all countries is a botnet.

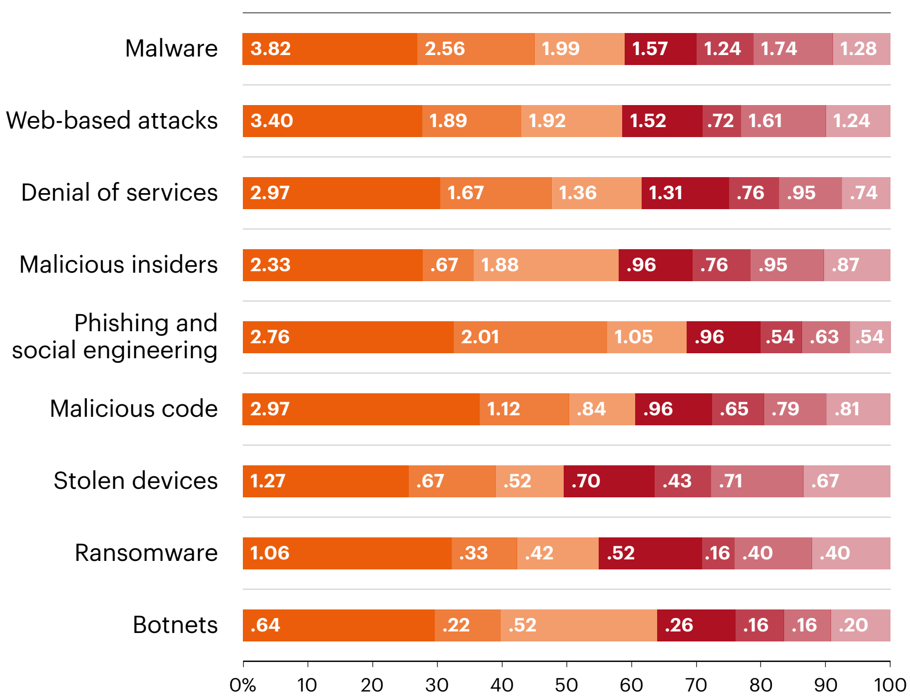


FIGURE 11

Annualized cyber crime cost by attack type and country

US$ millions

Legend

Consolidated view

n = 254 companies

- United States
- Germany
- Japan
- United Kingdom
- Australia
- France
- Italy

KEY FINDING 8

The cost of cyber crime is also influenced by the frequency of attacks.

Figure 12 reveals the most to least expensive cyber attacks when analyzed by the frequency of incidents. The most expensive attacks are malicious insiders, denial of service and malicious code.

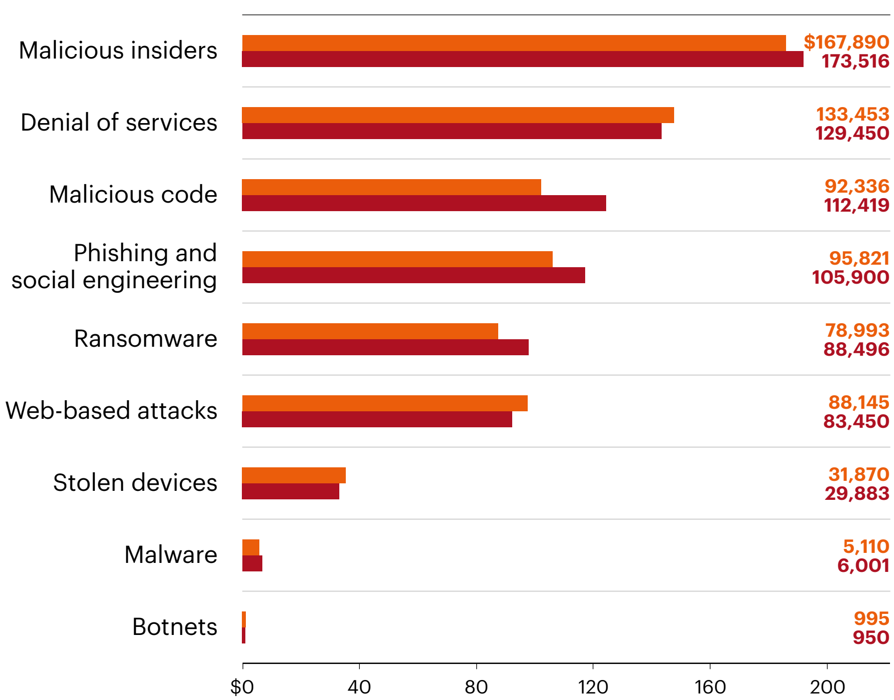


FIGURE 12
Average annualized cyber crime cost weighted by attack frequency

Legend
Consolidated view
n = 254 separate companies

FY 2016
FY 2017

KEY FINDING 9

Malware and Web-based attacks are the two most costly attack types.

As shown in Figure 13, companies spent an average of US$2.4 million and US$2 million on malware and Web-based attacks, respectively. Least costly are stolen devices, ransomware and botnets (US$865,985; US$532,914 and US$350,012, respectively).

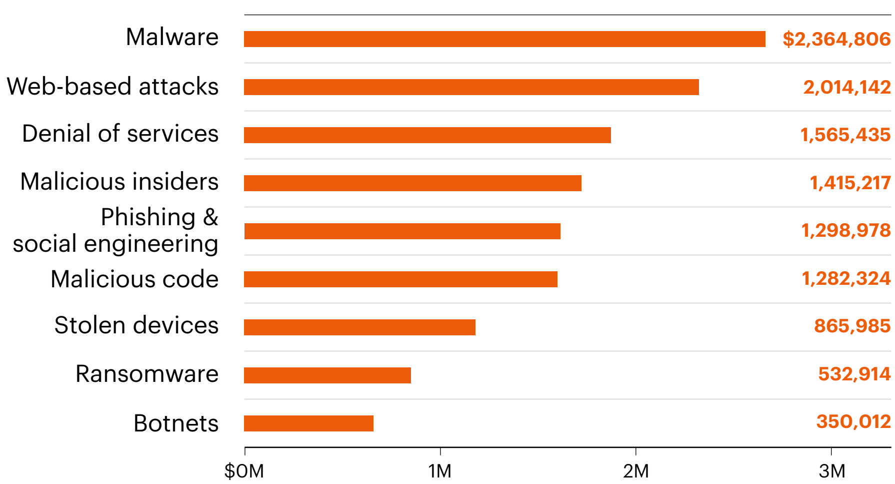


FIGURE 13
Total annualized cyber crime cost for attack types
US$ millions

Legend
Consolidated view
n = 254 separate companies

KEY FINDING 10

Malicious code attacks are taking longer to resolve and, as a result, are more costly.

As shown, the time it takes to resolve the consequences of the attack increases the cost of a cyber crime.

Figure 14 reports the average days to resolve cyber attacks for 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 code, malicious insiders and ransomware (hackers). Malware, viruses and botnets on average are resolved relatively quickly (that is, in a few days). Since 2016, companies are spending more time to deal with malicious code (between 49.6 days and 55.2 days) and less time to deal with Web-based attacks (between 25.3 and 22.4 days).

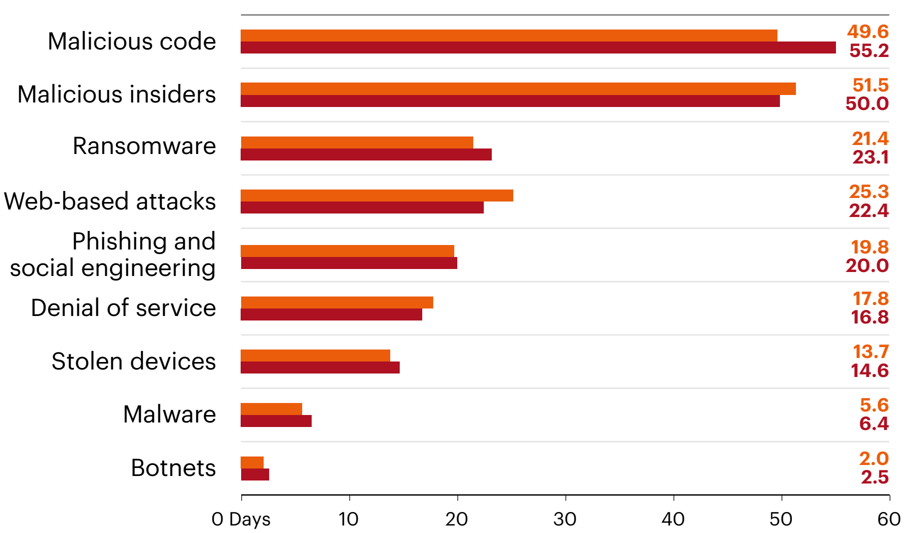


FIGURE 14
Length of time to resolve an attack in days
Estimated average time is measured for each attack type in days

Legend
Consolidated view
n = 254 separate companies

FY 2016
FY 2017

Analysis of the costs to resolve the consequences of the cyber attack

KEY FINDING 11

Information theft remains the most expensive consequence of a cyber crime.

In this research we look at four primary consequences of a cyber attack: business disruptions, the loss of information, loss of revenue and damage to equipment.

As shown in Figure 15, among the organizations represented in this study, information loss represents the largest cost component (43 percent). The cost of business disruption has decreased significantly from 39 percent in 2015 to 33 percent in this year's research. Business disruption costs include diminished employee productivity and business process failures that happen after a cyber attack. Revenue losses and equipment damages follow at 21 percent and 3 percent, respectively.

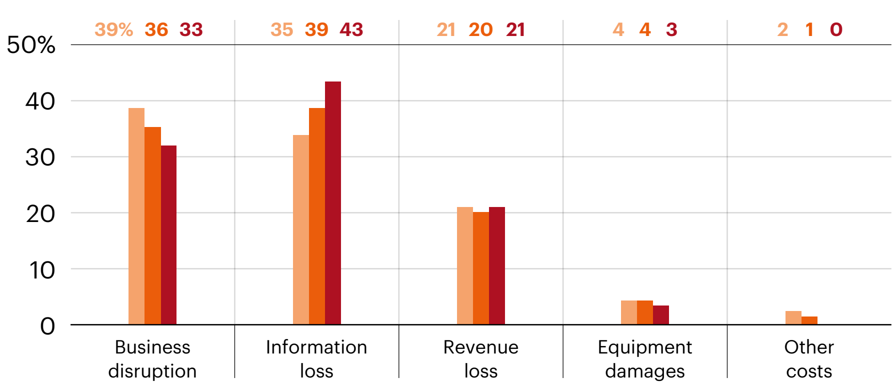


FIGURE 15
Percentage cost by consequence

Legend
Consolidated view
n = 254 separate companies

KEY FINDING 12

Companies spend the most on detection and containment.

Cyber crime detection and containment activities account for 56 percent of total internal activity cost (35 percent plus 21 percent), as shown in Figure 16. This is followed by recovery and investigation cost (at 20 percent and 11 percent, respectively). While detection costs have increased since 2015, recovery costs have decreased. Detection and recovery cost elements highlight a significant cost-reduction opportunity for organizations that are able to systematically manage recovery and deploy enabling security technologies to help facilitate the detection process.

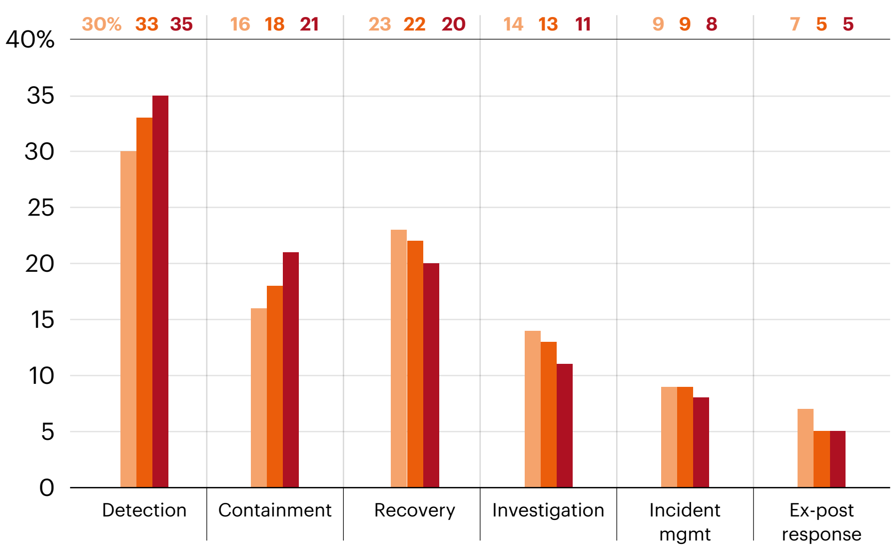


FIGURE 16
Percentage cost by internal activities

Legend
Consolidated view
n = 254 companies

- FY 2015
- FY 2016
- FY 2017

The percentage of annualized costs can be further broken down into five specific expenditure components, which include: productivity loss (31 percent) direct labor (26 percent), cash outlays (20 percent), indirect labor (17 percent) and overhead (6 percent). Costs not included in these components are represented in the "other" category (Figure 17).

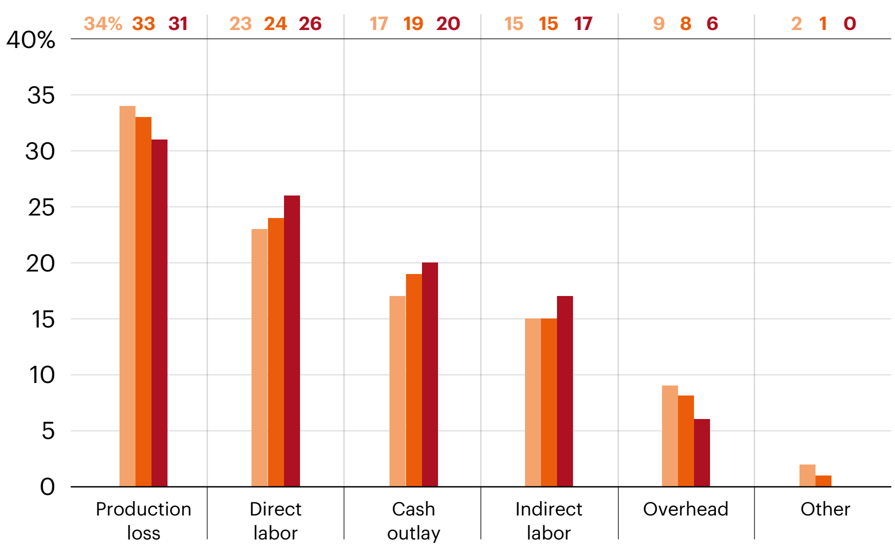


FIGURE 17
Percentage cost by specific components

Legend
Consolidated view
n = 254 companies

FY 2015
FY 2016
FY 2017

How companies allocate resources and achieve cost savings

KEY FINDING 13

Budget allocations are slowly shifting from the network to application and data layers.

Figure 18 summarizes six layers in a typical multi-layered IT security infrastructure for all benchmarked companies. Each bar reflects the percentage dedicated spending according to the presented layer. The network layer receives the highest allocation at 27 percent of total dedicated IT security funding. At only six percent, the host layer receives the lowest funding level.

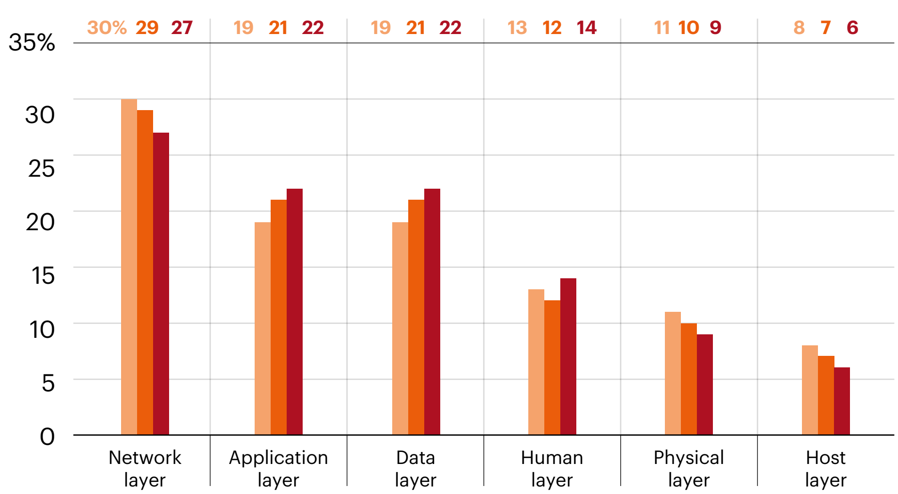


FIGURE 18
Percentage spending levels by six IT security layers

Legend
Consolidated view
n = 254 companies

FY 2015
FY 2016
FY 2017

Figure 19 shows nine enabling security technology categories by a subset of benchmarked companies. Each bar represents the percentage of companies fully deploying each given security technology. The top three technology categories include: security intelligence systems (67 percent), access governance tools (63 percent), and advanced perimeter controls (58 percent). Cyber analytics and UBA and automation, orchestration and machine learning are not widely deployed (32 percent and 28 percent, respectively).

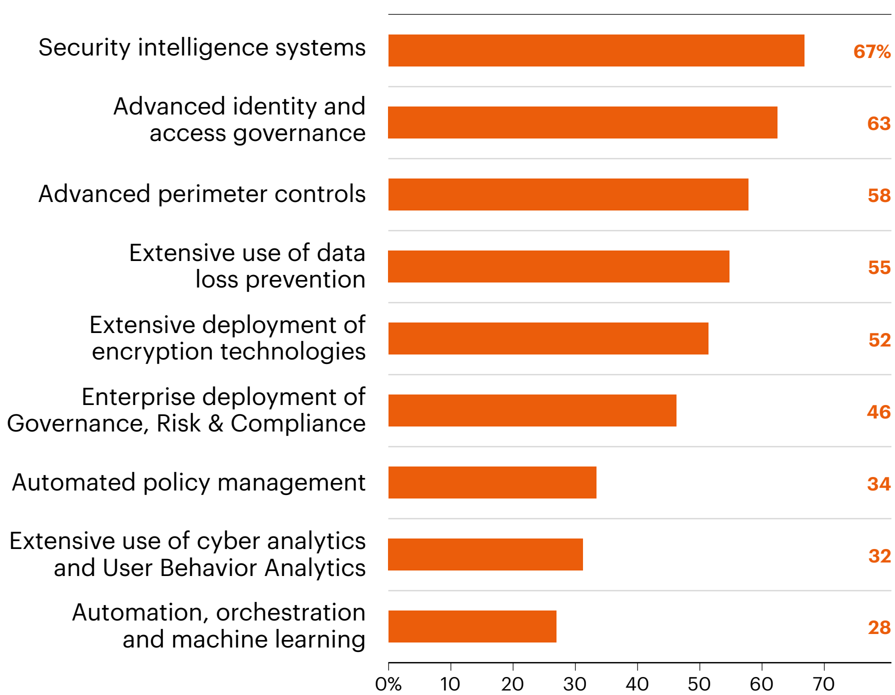


FIGURE 19
Nine enabling security technologies deployed

Legend
Consolidated view
n = 254 companies

Percentage deployment frequency

KEY FINDINGS

Figure 20 shows the money companies can save by deploying each one of nine enabling security technologies. For example, companies deploying security intelligence systems, on average, experience a substantial cost savings of US$2.8 million.

Similarly, companies deploying advanced identity and access governance tools experience cost savings of US$2.4 million on average. While not widely used, automation, organization and machine learning can provide significant cost savings (an average of US$2.4 million). Please note that these extrapolated cost savings are independent of each other and cannot be added together.

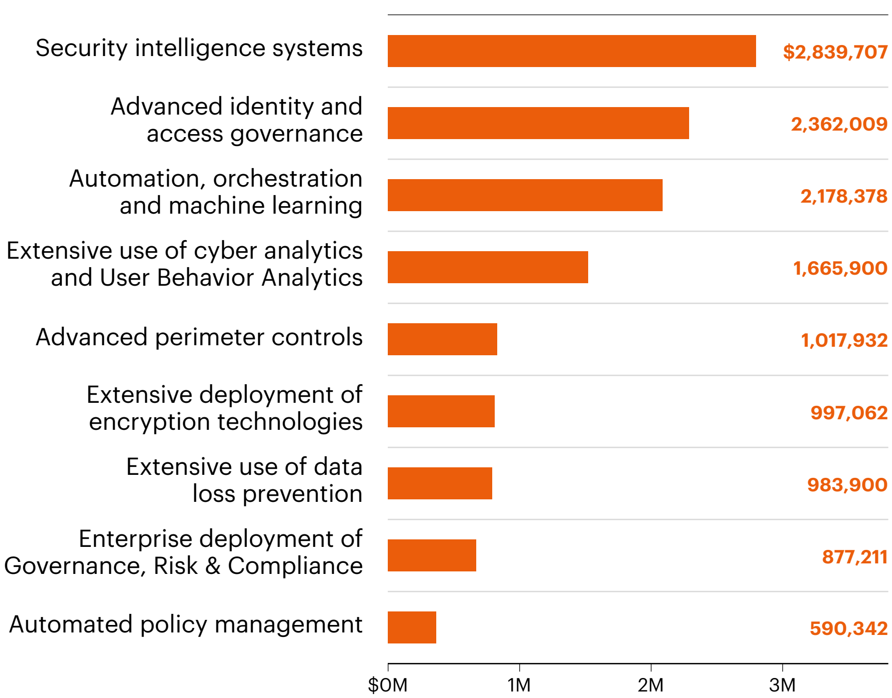


FIGURE 20
Cost savings when deploying enabling technologies

Legend
Consolidated view
n = 254 companies

Annual cost savings (US$)

KEY FINDING 14

Security intelligence systems have the biggest return on investment.

Figure 21 summarizes the estimated return on investment (ROI) realized by companies for each one of the nine categories of enabling security technologies.[5] At 21.5 percent, companies deploying security intelligence systems, on average, experience a substantially higher ROI than all other technology categories in this study.

Also significant are the estimated ROI results for companies that utilize advanced identity and access governance and automation, orchestration and machine learning technologies (19.7 percent and 17.1 percent, respectively). The estimated average ROI for all nine categories of enabling security technologies is 14.1 percent.

5: The return on investment calculated for each security technology category is defined as: (1) gains from the investment divided by (2) cost of investment (minus any residual value). We estimate a three-year life for all technology categories presented. Hence, investments are simply amortized over three years. The gains are the net present value of cost savings expected over the investment life. From this amount, we subtract conservative estimates for operations and maintenance cost each year. The net present value used the prime plus 2 percent discount rate per year. We also assume no (zero) residual value.

KEY FINDINGS

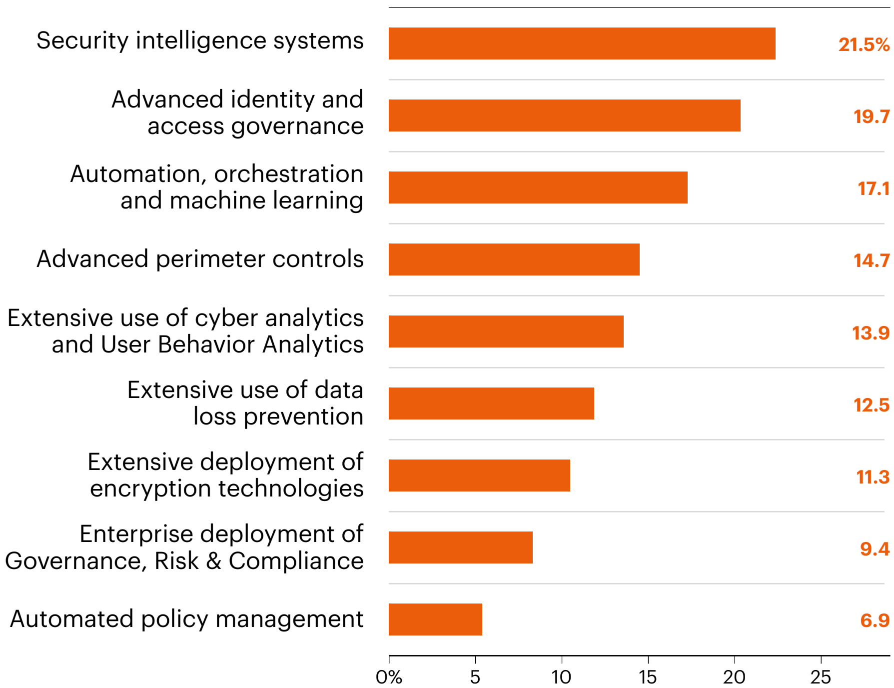


FIGURE 21
Estimated ROI for enabling security technologies

Legend
Consolidated view
n = 254 companies

- Estimated annual return on investment (ROI)

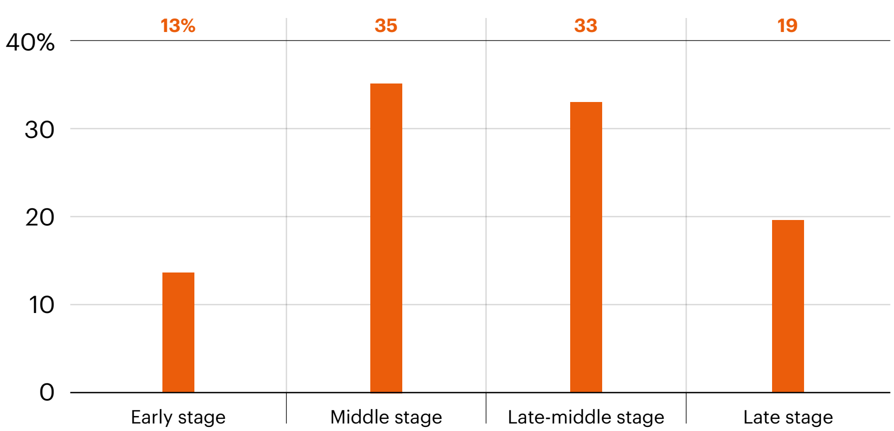


FIGURE 22
Distribution of the sample according to program maturity stage

Legend
n = 254 companies

- Stages of IT security program maturity

Maturity and effectiveness of an organization’s security posture

KEY FINDING 15

Program maturity is weighted toward the middle stages.

Figure 22 reports the distribution of our global sample of 254 companies according one of four maturity stages of the cybersecurity program, defined as follows:

- Early stage—many cybersecurity program activities have not as yet been planned or deployed
- Middle stage—cybersecurity program activities are planned and defined but only partially deployed
- Late-middle stage—many cybersecurity program activities are deployed across the enterprise
- Mature stage—most cybersecurity program activities are deployed across the enterprise

As can be seen, 35 percent of the sample is located in the middle stage. Only 13 percent of the sample is located in the early stage. Another 19 percent is located in the late stage.

KEY FINDING 16

Findings reveal a non-linear relationship between total cost of cyber crime and maturity stage of the cybersecurity program.

As can be seen in Figure 23, organizations in the early stage experience the lowest total cost at US$8.32 million. Middle stage organizations experience the highest total cost at US$13.87 million.

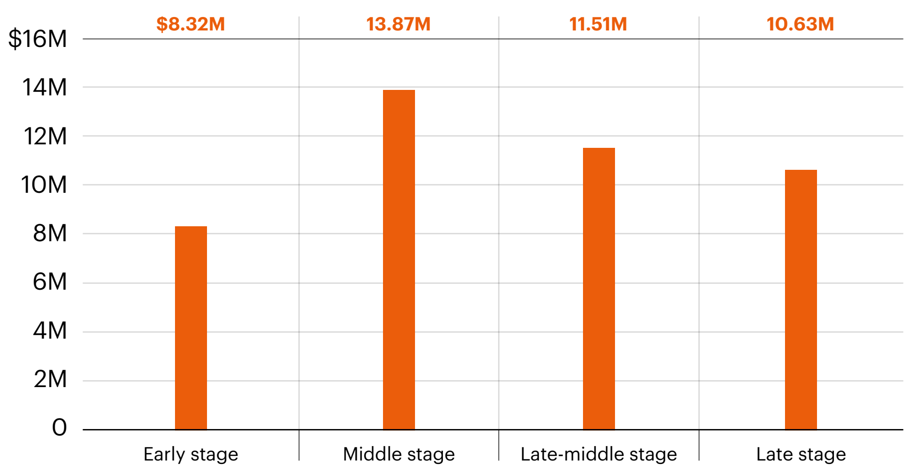


FIGURE 23
Total cost by program maturity stage

Legend
Mean = $11.7
n = 254 separate companies

Total cost (US$ millions)

KEY FINDING 17

Two countries have a negative security effectiveness score.

To better understand how security practises affect the total cost of cyber crime, we split the sample according to each company's security posture, which is measured by the Security Effectiveness Score (SES). Ponemon Institute developed this proprietary benchmarking methodology more than 10 years ago. The SES score is derived from rating numerous security practises, including the deployment of enabling security technologies.

This method has been validated from more than 50 independent studies conducted for more than a decade. The SES provides a range of +2 (most favorable) to -2 (least favorable) with a theoretical mean of zero. Hence, a score greater than zero is viewed as net favorable and a score less than zero is net unfavorable. A high favorable score (such as +1 or above) indicates that the organization's investment in people and technologies is both effective in achieving its security mission and is efficient in utilizing limited resources.

It is our belief that companies with a high SES are more cyber resilient and will have methods that will lessen the cost impact of cyber crimes. The mean SES for all 254 companies in our global sample is +.57. The highest SES was +1.76 and the lowest SES was -1.61. Figure 24 shows the mean SES by country sample. Germany achieved the highest overall SES at +1.03. In contrast, Italy had the lowest SES at -0.15. net favorable and a score less than zero is net unfavorable.

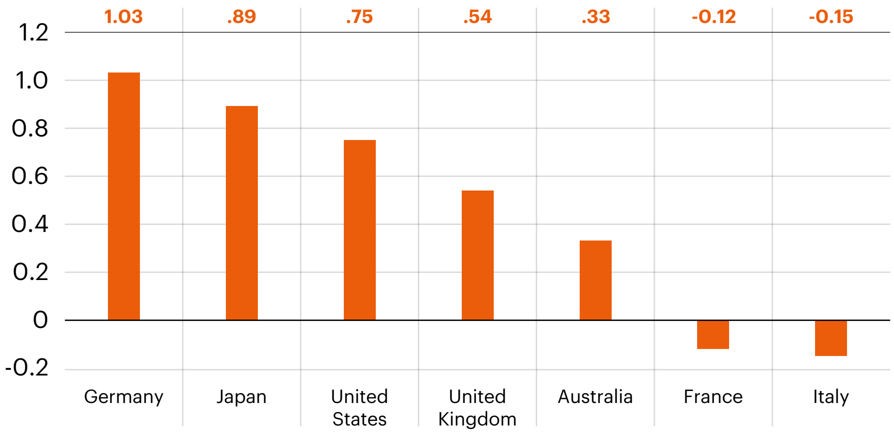


FIGURE 24
Average SES by country samples

Legend
Mean = +57
n = 254 separate companies

■ Security effectiveness score (SES)

KEY FINDING 18

The findings reveal a high SES decreases the total cost of cyber crime.

Organizations in the highest SES quartile experienced an average total cost of cyber crime at US$9.0 million. In contrast, organizations in the lowest SES quartile experienced an average total cost at US$15.3 million, as shown in Figure 25.

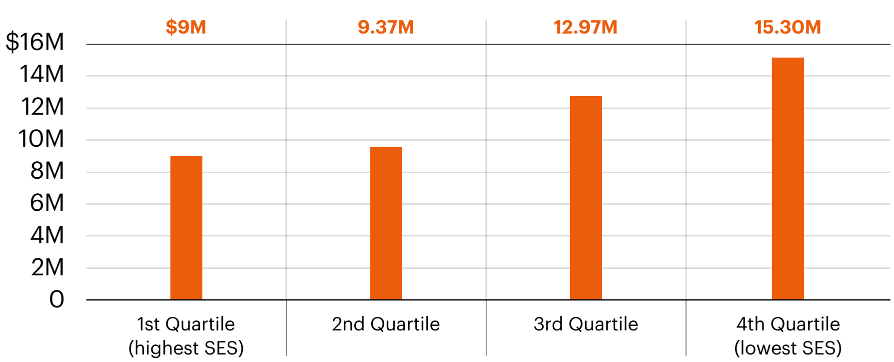


FIGURE 25
Total cost of cyber crime by SES quartile
US$ millions

Legend
Mean = $11.7
n = 254 separate companies

■ Total annualized cost ($US millions)

KEY FINDING 19

More investment is needed in breakthrough technologies.

Figure 26 presents the results of two independent rankings. The first ranking shows the order of nine (9) enabling security technologies as defined above. As shown, security intelligence systems provide the greatest cost savings, thus earning a rank equal to 9. In contrast, automated policy management provides the lowest savings, with a rank equal to 1.

The second ranking shows the order of enabling security technologies based on the percentage spending level during FY 2017. Here, security intelligence systems has a rank of 3 (third from the bottom). In terms of spending level, advanced perimeter controls has the highest rank of 9, but only a rank of 5 with respect to cost savings. Hence, differences or value gaps between these two rankings suggest possible inefficiencies in the allocation of resources on security solutions.

KEY FINDINGS

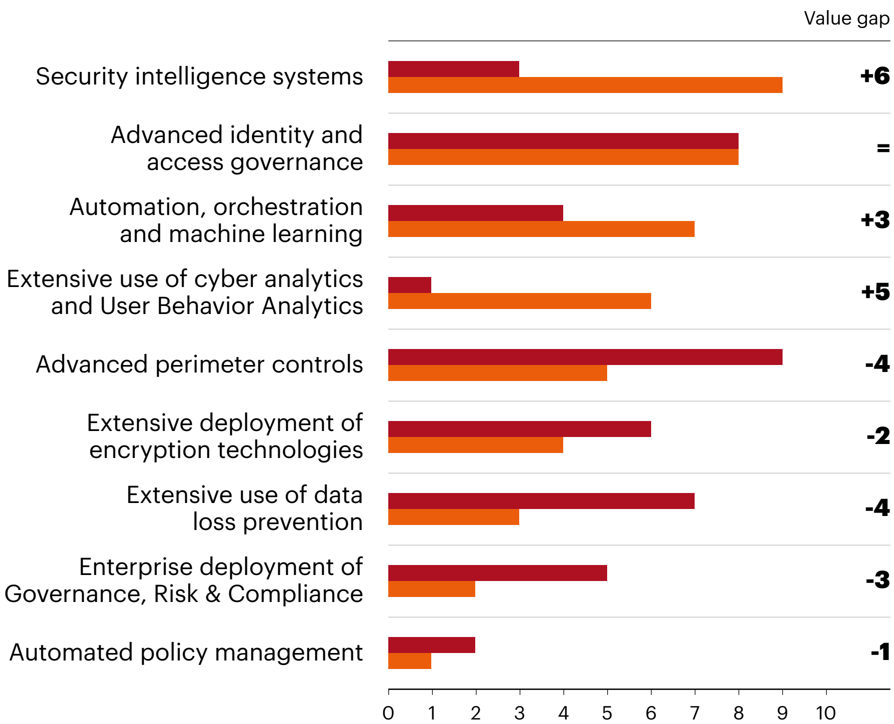


FIGURE 26
Rank orderings by spending levels and cost savings

Legend
9 = Highest rank
1 = Lowest rank

- Rank by percentage spending
- Rank by cost savings

COST OF CYBER CRIME
Frequently Asked Questions

What types of cyber attacks are included in this research?

For purposes of this study, we define cyber attacks as criminal activity conducted through the organization's IT infrastructure via the internal or external networks or the Internet. Cyber attacks also include attacks against industrial controls. A successful cyber attack is one that results in the infiltration of a company's core networks or enterprise systems. It does not include the plethora of attacks stopped by a company's firewall defenses.

How does benchmark research differ from survey research?

The unit of analysis in the *2017 Cost of Cyber Crime Study* is the organization. In survey research, the unit of analysis is the individual. In our experience, a traditional survey approach does not capture the necessary details required to extrapolate cyber crime costs. We conduct field-based research that involves interviewing senior-level personnel about their organizations' actual cyber crime incidents.

How do you collect the data?

In our 2017 study, our researchers collected in-depth qualitative data through 2,182 separate interviews conducted over a 10-month period in 254 companies in seven countries: the United States, the United Kingdom, Germany, France, Italy, Australia and Japan. In each of the 254 participating organizations, we spoke with IT, compliance and information security practitioners who are knowledgeable about the cyber attacks experienced by the company and the costs associated with resolving the cyber crime incidents. For privacy purposes we did not collect organization-specific information.

How do you calculate the cost?

To determine the average cost of cyber crime, organizations were asked to report what they spent to deal with cyber crimes over four consecutive weeks. Once the costs over the four-week period were compiled and validated, these figures were then grossed-up to determine the annualized cost. These are costs to detect, recover, investigate and manage the incident response. Also covered are the costs that result in after-the-fact activities and efforts to reduce business disruption and the loss of customers. These costs do not include expenditures and investments made to sustain an organization's security posture or compliance with standards, policies and regulations.

Are you tracking the same organizations each year?

For consistency purposes, our benchmark sample consists of only larger-sized organizations (that is, a minimum of approximately 1,000 enterprise seats).[6] Each annual study involves a different sample of companies. In short, we do not track the same sample of companies over time. To be consistent, we recruit and match companies with similar characteristics such as the company's industry, headcount, geographic footprint and size of data breach.

6: Enterprise seats refer to the number of direct connections to the network and enterprise systems.

Framework

The purpose of this research is to provide guidance on what a successful cyber attack can cost an organization. Our 2017 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. Cost figures have been converted into United States dollars for comparative purposes.[7]

In this study, we define a successful attack as one that results in the infiltration of a company's core networks or enterprise systems. It does not include the plethora of attacks stopped by a company's firewall defenses.

Figure 27 presents the activity-based costing framework used to calculate the average cost of cyber crime. Our benchmark methods attempt to elicit the actual experiences and consequences of cyber attacks. Based on interviews with a variety of senior-level individuals in each organization we classify the costs according to two different cost streams:

- The costs related to dealing with the cyber crime or what we refer to as the internal cost activity centers.
- The costs related to the consequences of the cyber attack or what we refer to as the external consequences of the cyber attack.

7: *The Wall Street Journal*'s August 16, 2017 currency conversion rates.

ABOUT THE RESEARCH

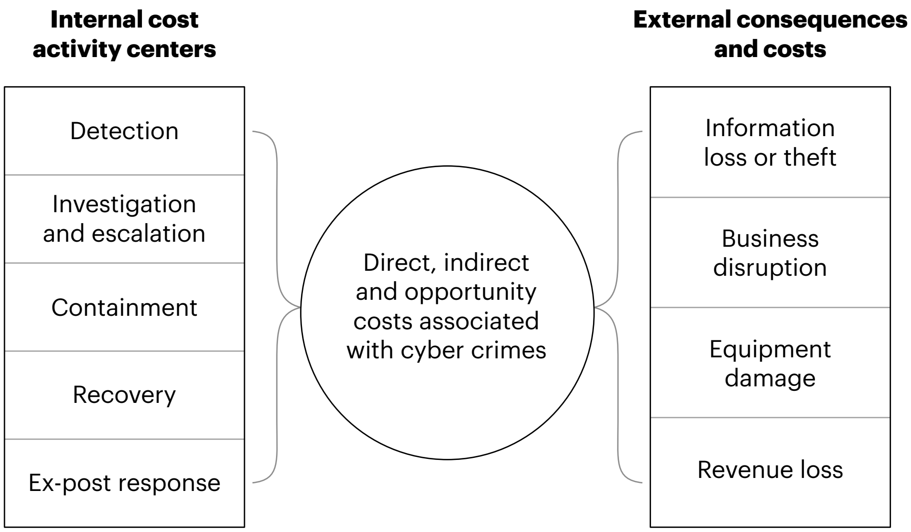


FIGURE 27
Cost framework for cyber crime

We analyzed the internal cost centers sequentially—starting with the detection of the incident and ending with the ex-post or final response to the incident, which involves dealing with lost business opportunities and business disruption. In each of the cost activity centers we asked respondents to estimate the direct costs, indirect costs and opportunity costs. These are defined as follows:

- Direct cost—the direct expense outlay to accomplish a given activity.
- Indirect cost—the amount of time, effort and other organizational 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.

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 nine discernible attack vectors: viruses, worms, trojans; malware; botnets;

Web-based attacks; phishing and social engineering; malicious insiders; stolen or damaged devices; malicious code (including SQL injection); and denial of services.[8]

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 centers in our framework include:[9]

Detection

Activities that enable an organization 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.

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 organize 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.

8: We acknowledge that these nine 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.
9: 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 multi-year investments in technologies.

Recovery

Activities associated with repairing and remediating the organization's systems and core business processes. These include the restoration of damaged information assets and other IT (data center) assets.

Ex-post response

Activities to help the organization minimize potential future attacks. These include containing costs from business disruption and information loss as well as adding new enabling technologies and control systems.

In addition to the above process-related activities, organizations often experience external consequences or costs associated with the aftermath of successful attacks—which are defined as attacks that infiltrate the organization's network or enterprise systems. Accordingly, our 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 organization 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 organization.

Benchmarking

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.

ABOUT THE RESEARCH

Cost estimation is based on confidential diagnostic interviews with key respondents within each benchmarked organization. Table 4 reports the frequency of individuals by their approximate functional discipline that participated in this year's global study.

TABLE 4
Individuals participating in the 2017 global study by functional discipline

Functional areas of interview participants	FREQUENCY	PERCENTAGE (%)
IT security	385	18
IT operations	401	18
Compliance	198	9
Data center management	185	8
Accounting & finance	116	5
Network operations	118	5
Legal	99	5
IT risk management	110	5
Physical security/facilities mgmt	98	4
Human resources	95	4
Internal or IT audit	80	4
Application development	69	3
Enterprise risk management	70	3
Procurement/vendor management	59	3
Industrial control systems	56	3
Quality assurance	43	2
TOTAL	**2,182**	**100**
Interviews per company on average	8.59	

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.

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 organization 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.

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.

We carefully limited items to only those cost activities we considered crucial to the measurement of cyber crime cost to keep the benchmark instrument to a manageable size. 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.

Field research was conducted over several months, concluding in August 2017. To maintain consistency for all benchmark companies, information was collected about the organizations' cyber crime experience was limited to four consecutive weeks. This time frame was not necessarily the same time period as other organizations in this study. The extrapolated direct, indirect and opportunity costs of cyber crime were annualized by dividing the total cost collected over four weeks (ratio = 4/52 weeks).

Sample

The recruitment of the annual study started with a personalized letter and a follow-up telephone call to 1,701 contacts for possible participation and 254 organizations permitted Ponemon Institute to perform the benchmark analysis.

Chart 1 summarizes the current (FY 2017) sample of participating companies based on 15 primary industry classifications. As can be seen, financial services (16 percent) represent the largest segment. This includes retail banking, insurance, brokerage and credit card companies. The second and third largest segments include industrial (12 percent) and services (11 percent).

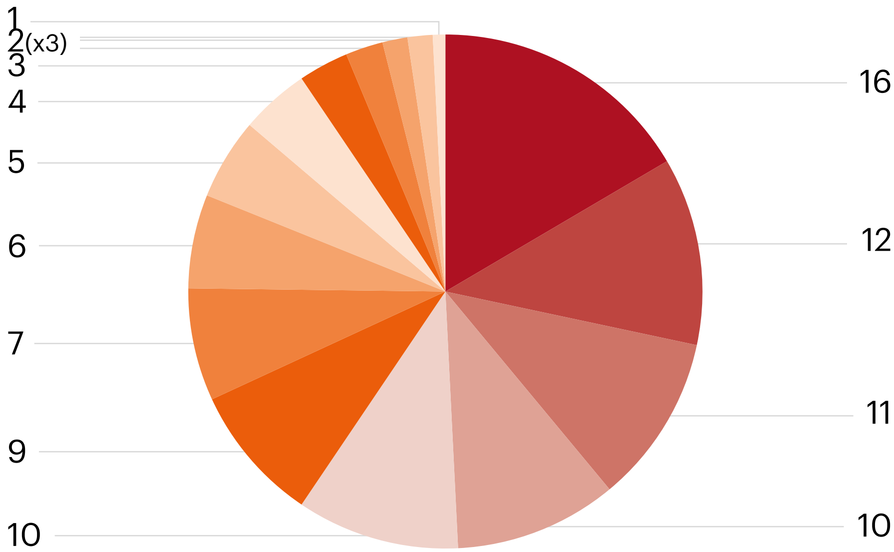


CHART 01
Industry sectors of participating organizations

Legend
Consolidated view
n = 254 separate companies

- Financial services
- Industrial/ manuf'ng.
- Services
- Tech and software
- Retail
- Public sector
- Utilities and energy
- Consumer products
- Healthcare
- Transportation
- Life science
- Hospitality
- Communications
- Education
- Aerospace and defense

Chart 2 shows 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 organizations with a minimum of approximately 1,050 seats. In the 2017 global study, the largest number of enterprise seats exceeded 259,000.

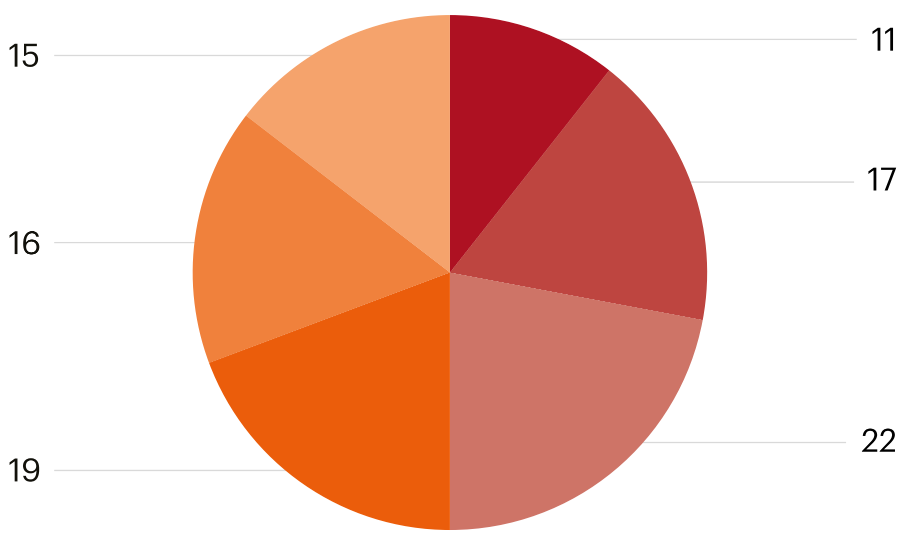


CHART 02
Distribution of participating organizations by enterprise seats (size)

Legend
Consolidated view
n = 254 separate companies

- < 2,000
- 2,000 to 5,000
- 5,001 to 10,000
- 10,001 to 15,000
- 15,001 to 25,000
- > 25,000

Limitations

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 organizations of mostly larger-sized 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 organizations, all believed to have experienced one or more cyber attacks. A total of 254 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. The current instrument does not capture company-identifying information. It also enables 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 organizational 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. Checks and balances were incorporated into the survey process. 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.

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