Information security threats encountered by Malaysian public sector data centers

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ABSTRACT

Data centers are primarily the main targets of cybercriminals and security threats as they host various critical information and communication technology (ICT) services. Identifying the threats and managing the risks associated with data centers have become a major challenge as this will enable organizations to optimize their resources to focus on the most hazardous threats to prevent the potential risks and damages. The objective of this paper is to identify major ICT security threats to data centers in the Malaysian public sector and their causes. The data for this study was collected through interview sessions. A total of 33 respondents from various government organizations were interviewed. The results revealed that the technical threats, spyware, phishing, bluesnarfling threats, social engineering and virus, trojan, malware, ransomware, viral websites threats are the major categories of threats often encountered by the malaysian public sector organizations. The causes for these threats are lack of budget, competent personnel, and manpower for security tasks, user awareness; lack of compliances and monitoring; insufficient security policies and procedures as well as deliberate cyber attacks. The outcome of this study will give a greater degree of awareness and understanding to the ICT security officers, who are entrusted with data center security.

Keywords:
Data center security threats
ICT security threats
Viral websites threats

1. INTRODUCTION

Technological advancements have broken the barriers between countries and the significance of time and place in communications has entirely transformed. The global cyber world connects countries, businesses and citizens completely in a new manner [1] and the information and communication technology (ICT) revolution has tremendously changed the way businesses and governments operate as well as the lifestyle of the citizens. The development of internet of things (IoT), which integrates computer technologies, communications technologies and various industry sectors too poses a big challenge and has created additional information security threats to the IoT applications [2]. In addition, with the change of human social interaction and adoption of emerging technologies, the number and range of information security threats are continuously growing although technological solutions have been improved considerably [3]. While the public sector, the economy, the business communities and citizens benefit from globally networked
services, the digital world has its own inherent vulnerabilities which may pose threats and cause security risks for everyone involved.

Data centers, in particular, have become the main target of cybercrimes and security threats as it hosts all the critical services such as applications, databases, websites, backups, and disaster recovery services. Organizations across the globe heavily dependent on data center infrastructure facilities, which serve as repositories for data storage with a variety of critical ICT assets [2]. As a result, identifying the threats and managing the risks associated with data centers has become a major challenge in the current cyber world. This study’s focus is to identify the major threats that are frequently encountered by the data centers in the Malaysian public sector. It reports the results of an exploratory study conducted at various organizations in the Malaysian Public Sector.

As the current world is digitally connected and ICT security threats seem to be unceasing despite the continuous effort, it is imperative for organizations to take necessary steps to ensure their data centers are secure and reliable. Knapp et al., [4] highlighted that the main security issues concerning modern data centers are particularly in regards to data center management, operations and physical security as well as disaster planning. According to [4-7] all disastrous threats that caused major business disruptions and damages to organizations, discussed by past researches were targeted at data centers. As a result, the security of data centers has become an utmost concern for both the government and the ICT industry with the increased societal reliance on internet-based cloud computing to provide secure and affordable storage. Thus, it is crucial for organizations to be able to predict the security risks and implement effective strategies to reduce them by implementing a systematic approach in managing information security [6-10] and the first step to ensure this is to identify the potential information security threats faced by the data centers effectively. This will enable organizations to apply right strategies and tactics to ensure successful information security management to protect organizational goal by curbing digital disruption [11].

According to [12], in Malaysia, cybercrimes and information security threats are expected to rise continuously and will become major concerns to public security and the economy of the country, which will pose dangerous threats if no effort is taken to curtail or prevent them. In 2017, it was reported that more than 150 countries worldwide, including Malaysia were affected by WannaCry with nearly 200,000 cases and the total actual number of attacks is unknown [13]. In 2019, the Malaysian computer emergency response team (MyCERT), a department under cyber security Malaysia, stated that over 400 defacement incidents occurred in Malaysia by 31st of August 2019, which included 19 government organizations [14]. Although the Malaysian government through various organizations have taken efforts to prevent cybercrimes and information security threats by introducing numerous cyber laws and regulations, control of such threats are still dependent on the people [12].

In view of the recurring and increasing ICT security threats in various forms and from various unknown sources targeting the data centers, it is vital for the Malaysian public sector organizations to identify all potential threats and associated risks proactively as well as systematically assess, control and monitor them to prevent any undesired incidents to safeguard the critical ICT assets from disastrous damages such as loss of sensitive and critical information; unavailability of critical systems and information; damages to hardware and software; and most importantly loss of clients’ confidence and reputation. This has become even more paramount now as the expectations and demands of the citizens continue to increase, and the government of Malaysia is currently implementing many citizen-centric services through end-to-end ICT applications to increase its efficiency, ease of doing business and global competitiveness.

Critical assets with vulnerabilities can be exploited by threats [15, 16], hence, it is important to protect them from internal and external threats such as the network intrusions, thefts, vandalism, virus, power failures, adverse environmental conditions, and any other security breaches [17]. The ICT assets that are classified as critical for an organization by [9, 15, 16, 18, 19] are information, data, site or facility, software, hardware, personal and organization’s structure. ICT infrastructures that are protected with sound and well-managed security program rarely encounter security breaches [20]. Therefore, it is crucial to identify the potential threats and mitigate the risks in time to protect the critical ICT assets, create a safe and secure ICT environment for business continuity.

Jouini et al., [21] proposed a multi-dimensional threat classification model based on criteria such as security threat source or point of origin; security threat agents or cause; security threat motivation, either malicious or non-malicious and security threat intention or the damage. The human threats still remain as a critical and challenging in modern-day business organizations and concurred by many information security specialists [22]. Sarkar [23] stated that insider threat, which is subtle and fundamentally a people issue is a reality when motivated by money or revenge and some well-meaning staff can compromise the security due to their overzealousness in getting their job done. Firoozjai et al., [24] classified the security threats related to network into three categories, namely the security threats of network infrastructure such as denial of service, network congestion, flooding attacks, information leakage and misuse of shared resources by users;
security threats of network functions virtualization providers such as malware injection, eavesdropping, functional violation, confidentiality compromisation, traffic sniffing, and distributed denial of service attack; and security threats of users such as information leakage and service violation. Zhang et al., [25] in their study, used the architecture of cyber-physical systems to classify the threats for the three layers, namely the perception-execution layer, which consists of physical equipment; the transport layer; and application-control layer.

Public administration, which adopted and operates on new technologies have become more sensitive to service disruption as it affects the reliability, efficiency and quality of their services [26]. Many countries and organizations have acknowledged the need to develop efficient solutions to increase the level of information security for permanent improvement in their delivery system to prevent any disruption and ensure service continuity [26]. Studies conducted previously on threats identification mainly were focused on specific areas such as insider threats, human threats, network front or general in nature. There were very few studies conducted on data center security [6] as only very few scholarly articles are available and none on the data centers in the Malaysian public sector.

2. RESEARCH METHOD

This study employed structured interview method for data collection. The interview questions were prepared based on a list of 86 potential information security threats that identified through systematic literature review, covering various aspects of the ICT operations, which can cause disruption and damage to an organization’s business operations as in Table 1. Risk assessment should focus on risks that are most likely to occur and cause serious impacts on organization’s operations [7, 27]. The list of threats was further divided into 8 categories based on their characteristics to better understand their impact on ICT assets. Categorization or classification of security threats helps organizations to identify and understand the threats that impact their assets and the effects better, hence, enable them to take the necessary preventive measures to protect their assets in a proactive manner [3, 21, 28].

A total of 33 respondents, representing various government organizations in the Malaysian public sector were selected for the interview. The respondents for this study were among the chief ICT security officers and officers in charge of the data center security. The interview questions were divided into 3 sections. Section 1 consisted of questions related to the demographic information of the respondent such as the name (optional), gender, current post, years of experience, as well as roles and responsibilities with regards to ICT security and data center. Section 2 focused on information on major ICT threats/risks faced in managing the data center. A list of 86 potential information security threats was identified and divided into 8 categories. The respondents were asked to rate them on a scale of 4-0 based on their experience (4=always, 3=often, 2=sometimes, 1=rarely and 0=never). This was followed by another question where the respondents were asked to rank the threat categories according to their frequencies on a scale of 1(most frequent) to 8 (least frequent). Next, they were asked to list down the possible causes for these ICT threats. Finally, Section 3 was queries on currently used guidelines/standards and best practices for risk assessment in managing ICT security risks in their organizations, namely the ISO 27005: information security risk management, ISO 27002: code of practice for information security controls, ISO 27001: information security management system and ISO 31000: risk management. Next, the respondents were also asked to state whether the Malaysian public sector should adopt a suitable Risk Assessment Framework/Methodology to manage the risks to ensure data center ICT security.

Table 1. Threats categories

| Num. | Threats Categories | Threat ID | Threat Title                                                                 |
|------|-------------------|-----------|-------------------------------------------------------------------------------|
| 1    | Virus, Trojan, Malware, | T01 | Introduction of virus, Trojan through unlicensed software / attempts          |
| 1    | Ransomware, Viral     | T02 | Malicious codes or Malware attacks / attempts                                 |
| 2    | Websites Threats    | T03 | Viral Websites - Introduction of virus, Trojan and malware through illegal websites |
| 2    | Spyware, Phishing, SPAM, Bluesnarfing Threats | T04 | Theft and Illegal usage/ misuse of personal information captured through Spyware. |
| 2    |                    | T05 | Phishing: Theft, disclosure and illegal use of sensitive financial or personal information through fraudulent email or instant messages. |
| 2    |                    | T06 | Bluesnarfing: Theft, disclosure of personal information through Bluetooth.  |
| 3    | Social Engineering | T07 | SPAM email                                                                   |
| 3    |                    | T08 | Attempts / Tricking computer users into revealing computer security or private information such as passwords, email addresses, etc. |

(Table continued)
| Num. | Threats Categories / Title | Threat ID | Threat Title |
|------|--------------------------|----------|--------------|
| 4    | Unsecured Wireless Access Points (WAP) | T10 | Network (LAN/ WAN/ WiFi) service failure/ unavailability |
|      |                          | T11 | Network congestion |
|      |                          | T12 | Eavesdropping (network function virtualization) |
|      |                          | T13 | Traffic sniffing |
|      |                          | T14 | Confidentiality compromisation (network function virtualization) |
|      | Network Service          | T15 | High volume of packet transmission or flooding attacks |
|      |                          | T16 | Control network denial of service attacks |
|      |                          | T17 | Aggregation node or nodes attacks |
|      |                          | T18 | Black hole / Packet drop attacks |
|      |                          | T20 | Wormhole attacks |
|      |                          | T21 | Trap doors Sybil attacks |
|      |                          | T22 | Earthquakes/ Tremor |
|      |                          | T23 | Flash Flood |
|      |                          | T24 | Fire |
|      |                          | T25 | Tsunami |
|      |                          | T26 | Haze drought |
|      |                          | T27 | Portal / Service disruption/ unavailability |
|      |                          | T28 | Application Systems failure/ Cannot be accessed |
|      |                          | T29 | Hardware malfunction (Server, Load balancer, Storage, Printer, etc) |
|      |                          | T30 | Software malfunction (OS, web service, etc) |
|      |                          | T31 | Failure/ faulty of network equipment (switches, routers, Netapp controller, etc) |
|      |                          | T32 | Failure/ faulty of security hardware & software (IPS, Firewall, Antivirus, etc) |
|      |                          | T33 | Faulty communication lines |
|      |                          | T34 | Electromagnetic leakages/ interferences |
|      |                          | T35 | Power surge/ trip/ failure |
|      |                          | T36 | Unpatched vulnerabilities of software (not known to the users until something occurs) |
|      |                          | T37 | Backup failure, Faulty/ defective storage media (tapes, hard disk, cartridges) |
|      |                          | T38 | Failure of database caused by technical faulty in hardware/ software error. |
|      |                          | T39 | External power supply failures. |
|      |                          | T40 | Internal power supply disruption/ failure (rack / fuse, etc) |
|      |                          | T41 | Air conditioning / Ventilation disruption / High temperature. |
|      |                          | T42 | Chiller system down/ faulty. |
|      |                          | T43 | UPS failure or related hardware faulty (battery & other parts). |
|      |                          | T44 | Accidental destruction / corruption of part of or whole database. |
|      |                          | T45 | Accidental Deletion of customer data. |
|      |                          | T46 | Accidentally Deleting proprietary software. |
|      |                          | T47 | Accidentally Deleting backups. |
|      |                          | T48 | Accidentally Deleting proprietary designs. |
|      |                          | T49 | Incompetency of internal staff. |
|      | Natural Disaster / Environmental | T50 | Incompetency of External Vendors in outsourced project (misconfiguration of hardware or software). |
|      |                          | T51 | Incompetency of Temporary / Contract staff. |
|      |                          | T52 | Hazards posed by janitors or cleaners (vacuum, sweep, wipe, empty thrash). |
|      |                          | T53 | Mishandling of critical ICT assets and other equipment. |
|      |                          | T54 | Misleading SOP and Procedures. |
|      |                          | T55 | Accidentally shutting down of hardware (servers, console, etc). |
|      |                          | T56 | Accidentally shutting down software (application, software, database, etc). |
|      |                          | T57 | Deliberate destruction / corruption of part of or whole database. |
|      |                          | T58 | Elevation of privilege. |
|      |                          | T59 | Unauthorised modification or deletion of customer data. |
|      |                          | T60 | Planting logic bombs in application systems. |
|      |                          | T61 | Deleting proprietary software or designs. |
|      |                          | T62 | Deleting backups. |
|      |                          | T63 | Denial of services / legitimate access. |
|      |                          | T64 | Denial of information usage / unavailability of data. |
|      |                          | T65 | Service violation attacks. |
|      |                          | T66 | Distributed denial of service attack. |
|      |                          | T67 | Physical attacks. |
|      |                          | T68 | Pandemics. |
|      |                          | T69 | Riots. |
|      |                          | T70 | Wars. |
|      |                          | T71 | Terrorist attacks. |
|      |                          | T72 | Unauthorised Access to data center facility/ restricted area (illegal entry). |
|      |                          | T73 | Vandalism /theft / loss of hardware/ software. |
|      |                          | T74 | Website Defacement / Compromised. |
|      |                          | T75 | Unauthorised access to servers / critical systems. |
|      |                          | T76 | Sabotage by Internal staff (integrity). |
|      |                          | T77 | Sabotage by External Vendors in outsourced project (integrity). |

(Table continued)

Information security threats encountered by Malaysian public sector data centers (Inthrani Shammugam)
Sabotage by Temporary/Contract staff (integrity).
Attempts to hack IP/intrusion/invasion of network threats.
SQL injection.
Cross site scripting.
Data breach/information Leakage.
Privacy in data mining.
Control command forged attacks.
Shutting down of hardware (servers, console, etc).
Shutting down software (application, software, database, etc).

3. RESULTS AND DISCUSSION
3.1. Respondents and experiences
About 33 government organizations were selected for the interview and the respondents consist of 15 (45%) females and 18 (55%) males. The analysis also revealed that 4 (12%) respondents have more than 15 years of experience, 7 (21%) have 11-15 years of experience, 9 (27%) have 5-10 years of experience and 13 (40%) have less than 5 years of experience in managing data centers.

3.2. Threats frequencies
The analysis of the data obtained for the frequency of the threats shows that the top three threats rated 4 (always) were the technical threat (13), social engineering (12) and deliberate human threats (10). This was followed by the spyware, phishing and bluesnarfing threats (8), virus, trojan, malware, ransomware, viral websites threats and deliberate human threats (5), accidental human error (4) and unsecured wireless access points (WAP)/network threats (2). No respondent selected the natural disaster/environmental threats under this category. Figure 1 illustrates the analysis results of the frequencies of the major ICT security threats encountered by data centers in the Malaysian Public Sector.

It was also discovered that the top three threats rated 3 (often) were spyware, phishing, bluesnarfing threats (13), technical threats (12) and social engineering (10). This was followed by deliberate human threats (9), unsecured wireless access points (WAP)/network (7), virus, trojan, malware, ransomware, viral websites threats (6), and accidental human error (5). There was no response for the natural disaster/environmental threats under this category. The top three threats rated 2 (sometimes) were the accidental human error (13), unsecured wireless access points (WAP)/network (13), and spyware, phishing, bluesnarfing threats (11). This is followed by the virus, trojan, malware, ransomware, viral websites threats (10), deliberate human threats (8), technical threats (7), social engineering (6), and natural disaster/environmental threats (1). The three threats categories rated 1 (rarely) were the virus, trojan, malware, ransomware, viral websites threats (12), the accidental human error (11), and unsecured wireless access points (WAP)/network (11). This was followed by deliberate human threats (6), natural disaster/environmental threats (6), social engineering (5), technical threats (1), and spyware, phishing, bluesnarfing threats (1). The only threats category that fell under the 0 (never) rating was the natural disaster/environmental threats with 26 responses.

![Frequency of ICT Security Threats Encountered by Data Centers in Malaysian Public Sector](image_url)

Figure 1. Frequencies of ICT security threats encountered by data centers in the Malaysian public sector
3.3. Threats ranking

Figure 2 depicts the ranking analysis of the threat categories based on their frequencies on a scale of 1(most frequent) to 8(least frequent). The results show that the most frequent threats (highest to lowest based on the total for 1-Most to 4 only) are the Technical threats (28), Spyware, Phishing, Bluesnarfing Threats (24), Social Engineering (24), Virus, Trojan, Malware, Ransomware, Viral Websites Threats (22), Deliberate Human Threats (17), Unsecured Wireless Access Points (WAP)/Network (10), Accidental Human Error (7) and the Natural Disaster/Environmental (0). These ranking results closely match the results for the previous question and indicates the consistency of the respondents in their answers.

![Figure 2. Ranking of the threat categories by frequencies](image)

3.4. Causes of the threats

The Table 2 shows the causes of the threats cited by the respondents.

| Num | Threats Categories | Causes                                                                 |
|-----|-------------------|----------------------------------------------------------------------|
| 1   | Virus, Trojan, Malware, Ransomware, Viral Websites Threats. | Vulnerabilities in hardware/software, Unpatched/un-updated software, Lack of security awareness/education, Unintentionally downloading free software/email attachments from unknown source, Clicking on false advertisement, Accessing malicious website/software, Inadequate or weak security policies/procedures, Failure to follow or violating policies/procedures & Lack of monitoring. |
| 2   | Spyware, Phishing, Bluesnarfing Threats. | Lack of security awareness/education, Too many phishing emails/attachments/links to viral websites that confuse the users, Clicking on false advertisement, Inadequate or weak security policies/procedures, Failure to follow or violating policies/procedures, Too many spyware and malware at network layer & Lack of monitoring. |
| 3   | Social Engineering. | Too many SPAM emails, SPAM emails come with new email addresses even after being blocked & Lack of security awareness/education. |
| 4   | Unsecured Wireless Access Points (WAP)/Network | Lack of competency in handling critical hardware/software, Obsolete hardware/software and products that have reached end of life, Old hardware specifications that do not meet the current requirements, Vulnerabilities in network hardware/software, Unsupported hardware/software & Unpatched/Un-updated hardware/software. |
| 5   | Natural Disaster/Environmental | Lack of competency in identifying the right location & Flood due to failure to identify right location for data center. |
| 6   | Technical Threats | Lack of budget to replace obsolete hardware/software and products that has reached end of life, High cost of maintenance, Lack of dedicated staff to focus on ICT security tasks, Lack of competent personnel, Legacy application systems, Old hardware specifications that do not meet the current requirements, Vulnerabilities in old hardware/software and legacy application systems, Unsupported hardware/software, Unpatched/Un-updated software, Inadequate standard operating procedure (SOP)/service level agreement (SLA) & Lapse of contract. |
| 7   | Accidental Human Threats | Lack of competency in handling critical hardware/software, Inadequate standard operating procedure (SOP)/service level agreement (SLA), User negligence & Lack of monitoring. |
| 8   | Deliberate Human Threats | Common attacks by outsider/hackers, Information leakage and theft, Web defacement and malicious code injection, Distributed denial of service attacks, Inadequate or weak security policies/procedures, Lack of compliances and monitoring, Inadequate standard operating procedure (SOP)/service level agreement (SLA), Lack of preventive measures, Weak access control and poor access management, Failure in implementing risk assessment on ICT assets & Lack of enforcement on ICT security compliance and audit. |
3.5. Technical threats

The analysis results revealed that these are the most frequent and highest ranked threats by the data centers in the Malaysian public sector. The main cause of these threats are the constraints or lack of resources in terms of budget and manpower. Many have no choice but to continue using obsolete hardware/software. This hardware/software are not supported in terms of maintenance by the suppliers and the latest patches are not being updated. As a result, these hardware and software are very vulnerable and always/often breakdown or experience other technical issues. Another factor that contributes to the technical issues is the lack of experienced, skilled personnel and dedicated personnel to manage ICT security related tasks. The results also show that 40% of the respondents have only less than 5 years of experience in managing ICT security and data centers. This lack of experience leads to mishandling of critical hardware and software as well as negligence.

3.6. Spyware, phishing, bluesnarfing threats, social engineering threats and virus, trojan, malware, ransomware, viral websites threats

These are the next highly encountered and ranked threats categories. Many reasons were mentioned in Table 2. However, the main contributing factor was the lack of awareness and education of the users, which in turn contributed to other factors such as being manipulated clicking on false advertisements and attachments from unknown sources and websites. In addition, factors such as the vulnerabilities of obsolete and outdated hardware/software, lack of strong ICT security policies and failure to adhere to them have also contributed to these threats.

3.7. Deliberate human threats

This category has become a critical challenge which has been continuously faced by the whole world. This is also one of the frequently encountered threats by the data centers in Malaysia as reported by [13, 14]. Some of the reasons cited for these threats were the weak and inadequate ICT security policies/procedures, lack of preventive measures, failure in implementing risk assessment on ICT assets and lack of enforcement on ICT security compliances and audits. These create vulnerabilities in the access system and ICT assets and provide opportunity for deliberate human threats.

3.8. Unsecured wireless access points/network and accidental human error threats

The next 2 categories were the “Unsecured Wireless Access Points/Network” and the “Accidental Human Error Threats”. The reasons cited for these threats were the lack of resources and incompetent personnel. Lack of competency in handling critical hardware/software coupled with negligence also contributed to these threats. This is evident from the results which revealed that 40% of personal managing the ICT security and data centers have less than 5 years of experience. Besides that, the usage of obsolete/unlicensed/unsupported network equipment were also a source of threats.

3.9. Natural disaster/environmental

This threat is something that was rarely encountered by the data centers in Malaysia. This category falls at the bottom of the ranking list and only one respondent responded to this threat. The respondent stated that the cause was due to a failure in identifying the right locate/on for the data center. It must be noted that Malaysia faced a major flood which was described as the worst flood in decades in 2014 [29]. Some government agencies with data centers located in east coast states were affected by this major flood.

3.10. Risk assessment methods and guidelines currently in use

For this, the respondents cited a few methods or guidelines, 15 respondents mentioned that they use the Malaysian risk assessment method (MyRAM) and Malaysian public sector information security high-level risk assessment (HiLRA). 5 respondents stated that they refer to the public sector ICT security policy or Agency’s ICT Security Policy. 2 respondents cited the ISO/IEC27001. 11 (33%) respondents didn’t state anything. The responses also revealed that there was a lack of adherence and monitoring on the agency’s side in ensuring risk assessment is done on their critical ICT assets.

3.11. Should the Malaysian public sector adopt a suitable risk assessment framework/methodology to effectively prevent, mitigate and manage the risks and challenges in ensuring data center ICT security?

For this, 31 respondents (94%) indicated that they need a suitable risk assessment methodology whilst 2 (6%) stated that it was not required. This feedback shows that majority of the personnel in charge of ICT security or data center security believe that there is a need for a suitable risk methodology to effectively manage the risks and other security related challenges in their organizations.
The results have revealed the frequent information security threats encountered by the data centers in the Malaysian Public Sector and the causes. This will enable the organizations to optimize their limited resources, adopt right strategies to curb these threats, ensure service continuity and curtail damages to safeguard their reputation.

4. CONCLUSION

This paper discussed an exploratory study of the major ICT security threats to data centers of 33 government organizations. The are 8 categories of common threats that occur in data centers in Malaysian Public Sector were used in this study to identify their frequencies and to determine their ranking as well as to identify their causes. It was discovered that the technical threats, spyware, phishing, bluesnarfing threats, social engineering and virus, trojan, malware, ransomware, viral websites threats are the major threats often encountered by the organizations. The main causes for these threats are the lack of resources in terms of budget and competent personnel, lack of manpower to focus on security tasks, lack of user awareness and education, weak or insufficient security policies and procedures, lack of compliances and monitoring, and deliberate attacks by hackers. Although the data collected from the respondents was relatively consistent with very little variation, the frequencies of the threats and ranking may be different for other organizations. This is because agencies with strong ICT security policies, continuous awareness or education programs, sufficient ICT budget allocation, adherence to compliances and close monitoring may not have high frequencies in the categories of threats identified. A resilient, well maintained and monitored security system with continuous support from all interested parties will better prevent any undesired security breaches. In conclusion, this study has successfully identified major ICT security threats that frequently encountered by data centers in the Malaysian public sector. The outcome of the study will give a greater degree of awareness and understanding to the ICT security officers, who are entrusted with data center security. This will also enable them to optimize their limited resources, focus on the most frequent threats and implement the necessary controls to thwart the potential risks and curb damages to safeguard organization’s reputation, customer confidence and image of the Malaysian public sector.

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Information security threats encountered by Malaysian public sector data centers (Inthrani Shammugam)

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