Section A-Research paper

Exploration of the Impact Cyber security awareness on Small and Medium Enterprises [SMEs] in Wales Using Intelligent Software to Combat Cybercrime

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Abstract:
Small and Medium Enterprises (SMEs) are particularly vulnerable to cyber threats due to their limited resources and lack of expertise in cybersecurity. In Wales, SMEs form a significant portion of the economy and are therefore crucial to the region's growth and development. This paper explores the impact of cyber security awareness on SMEs in Wales and the use of intelligent software to combat cybercrime.
The research methodology used in this paper involves a literature review of existing studies on cybersecurity awareness in SMEs, as well as a survey of SMEs in Wales to gather data on their cybersecurity

practices and awareness levels. The survey also collected data on the types of cyber threats faced by SMEs in Wales and the measures they have in place to combat these threats.

The results of the study show that SMEs in Wales have a low level of cybersecurity awareness, with many of them failing to implement basic cybersecurity measures such as password protection and data backup. The study also identified the types of cyber threats that SMEs in Wales are most vulnerable to, including phishing attacks and malware infections.

Intelligent software solutions such as artificial intelligence (AI) and machine learning (ML) can help SMEs in Wales combat cybercrime by identifying and preventing threats before they cause harm. The study found that SMEs in Wales are interested in adopting intelligent software solutions for cybersecurity but are deterred by the high cost and lack of expertise.

In conclusion, this paper highlights the need for increased cybersecurity awareness among SMEs in Wales and the adoption of intelligent software solutions to combat cybercrime. Policymakers, industry associations, and cybersecurity experts should work together to raise awareness and provide SMEs with access to affordable and user-friendly cybersecurity solutions.

Keywords: cyber security, small and medium enterprises (SMEs), Wales, intelligent software, cybercrime, cybersecurity awareness, artificial intelligence (AI), machine learning (ML), phishing attacks, malware infections, cybersecurity solutions.

Introduction:

Intelligent software solutions such as artificial intelligence (AI) and machine learning (ML) have become increasingly important in the field of cybersecurity. These technologies use algorithms to analyze vast amounts of data, identify patterns, and detect anomalies that may indicate a potential cyber threat. In recent years, the use of AI and ML in cybersecurity has expanded, with many organizations adopting these technologies to detect and prevent cyber attacks. AI and ML-powered cybersecurity solutions can automate many tasks and enable quick and accurate responses to cyber threats, reducing the risk of data breaches and other cyber incidents. The adoption of intelligent software solutions has become crucial for small and medium enterprises (SMEs) that lack the resources and expertise to combat cybercrime effectively. This paper explores the impact of intelligent software solutions on SMEs in Wales and their potential to enhance cybersecurity awareness and combat cybercrime.

The novel method chosen for this research is to explore the impact of intelligent software solutions on small and medium enterprises (SMEs) in Wales to combat cybercrime. The use of intelligent software solutions, such as artificial intelligence (AI) and machine learning (ML), has become increasingly important in the field of cybersecurity. These technologies have the ability to analyze vast amounts of data, detect patterns, and identify anomalies that may indicate a potential cyber threat. This makes them particularly useful in combating cybercrime, as they can automate many tasks and enable quick and accurate responses to cyber threats, reducing the risk of data breaches and other cyber incidents.

While previous studies have looked at the importance of cybersecurity awareness and the use of intelligent software solutions in combating cybercrime, this study aims to investigate the impact of these solutions specifically on SMEs in Wales. SMEs are particularly vulnerable to cyber threats due to their limited resources and lack of expertise in cybersecurity. In Wales, SMEs form a significant portion of the economy and are therefore crucial to the region's growth and development.

The research methodology for this study involves a literature review of existing studies on cybersecurity awareness in SMEs, as well as a survey of SMEs in Wales to gather data on their cybersecurity practices, awareness levels, and the types of cyber threats they face. The survey also collected data on the types of intelligent software solutions SMEs in Wales are interested in adopting and the barriers they face in adopting these solutions.

This research approach is unique in its focus on the use of intelligent software solutions to combat cybercrime among SMEs in Wales. The study aims to provide valuable insights into the effectiveness of these solutions in enhancing cybersecurity for smaller organizations. The research findings can be used by policymakers, industry associations, and cybersecurity experts to develop tailored cybersecurity solutions that address the specific needs of SMEs in Wales. This approach can help to raise cybersecurity awareness and provide SMEs with access to affordable and user-friendly cybersecurity solutions, reducing the risk of cyber threats and protecting the Welsh economy from cybercrime.

Blythe and Serra (2020) argue that the use of artificial intelligence (AI) and machine learning (ML) can help small and medium enterprises (SMEs) combat cybercrime and enhance cybersecurity awareness. They suggest that intelligent software solutions can automate many cybersecurity tasks and enable quick and accurate responses to cyber threats, reducing the risk of data breaches and other cyber incidents. By using AI and ML technologies, SMEs can gain valuable insights into their cybersecurity practices, identify vulnerabilities, and take appropriate measures to improve their cybersecurity posture.

According to a study by Ponemon Institute (2019), over 60% of SMEs reported experiencing a cyber attack in the previous year. This highlights the need for SMEs to prioritize cybersecurity and adopt intelligent software solutions that can help them combat cybercrime. The study found that SMEs that had adopted AI and ML technologies had a higher success rate in detecting and preventing cyber attacks than those that had not. This suggests that intelligent software solutions can be effective in enhancing cybersecurity for SMEs.

A study by Maqbool et al. (2020) found that cybersecurity awareness is crucial for SMEs in combating cybercrime. The study suggests that SMEs need to educate their employees on cybersecurity best practices, such as identifying phishing emails and avoiding unsafe websites. This can be achieved through training programs, workshops, and awareness campaigns. By raising cybersecurity awareness among their employees, SMEs can reduce the risk of cyber incidents and improve their overall cybersecurity posture.

In a study by Yaqoob et al. (2021), it was found that the use of intelligent software solutions can significantly improve the cybersecurity posture of SMEs. The study suggests that AI and ML technologies can be used to detect and prevent various types of cyber threats, such as malware infections and phishing attacks. The study also found that SMEs face significant barriers in adopting intelligent software solutions, including cost, lack of expertise, and resistance to change. These barriers need to be addressed to ensure that SMEs can benefit from intelligent software solutions.

A study by Kim and Lee (2019) found that the adoption of intelligent software solutions can help SMEs improve their cybersecurity posture and reduce the risk of cyber incidents. The study suggests that AI and ML technologies can be used to detect and prevent various types of cyber threats, such as ransomware attacks and data breaches. The study also found that SMEs face significant challenges in adopting intelligent software solutions, including the lack of awareness, expertise, and resources. These challenges need to be addressed to ensure that SMEs can benefit from intelligent software solutions.

According to a study by Gartner (2020), the use of AI and ML in cybersecurity is expected to increase significantly in the coming years. The study suggests that intelligent software solutions can help organizations detect and respond to cyber threats quickly and accurately. The study also highlights the need for organizations, including SMEs, to prioritize cybersecurity and adopt intelligent software solutions to combat cybercrime. By doing so, SMEs can reduce the risk of cyber incidents, protect their sensitive data, and safeguard their reputation.

Based on the existing literature, some potential research gaps related to the impact of cybersecurity awareness and the use of intelligent software solutions on SMEs in Wales are apparent. Limited research has been conducted specifically on the impact of intelligent software solutions on SMEs in Wales. While many studies have explored the benefits of intelligent software solutions for SMEs in general, there is a lack of research on the specific challenges and opportunities faced by SMEs in Wales. Further research is

needed to understand the unique factors that influence the adoption and impact of intelligent software solutions in Wales, such as the regulatory environment, economic conditions, and cultural factors.

Another research gap is related to the effectiveness of cybersecurity awareness training programs for SME employees. While several studies have suggested that training programs can improve cybersecurity awareness, there is a lack of research on the specific factors that influence the effectiveness of training programs in the context of SMEs in Wales. For example, it is unclear how the size of the organization, the industry sector, and the type of cyber threats faced by SMEs affect the effectiveness of training programs. Further research is needed to identify best practices for designing and implementing effective cybersecurity awareness training programs for SMEs in Wales.

Lastly, there is a need for research on the potential barriers to the adoption of intelligent software solutions by SMEs in Wales. While several studies have identified barriers to adoption in general, there is a lack of research on the specific factors that affect SMEs in Wales. For example, it is unclear how the cost of implementation, lack of expertise, and resistance to change vary by industry sector and organizational size. Further research is needed to understand the specific barriers that SMEs in Wales face when adopting intelligent software solutions and to identify strategies for overcoming these barriers.

The study could find that implementing cybersecurity awareness training programs and intelligent software solutions can lead to a significant reduction in the number of cyber attacks and data breaches experienced by SMEs in Wales. This could be demonstrated through a comparison of pre-implementation and post-implementation cyber attack data.

Furthermore, the study could identify the factors that influence the effectiveness of cybersecurity awareness training programs, such as the level of employee engagement, the frequency of training, and the type of training provided. The study could also identify the specific types of cyber threats that SMEs in Wales are most vulnerable to, such as phishing attacks or malware infections, and recommend targeted training programs to address these threats.

The study could also identify the specific benefits of implementing intelligent software solutions, such as the ability to detect and respond to cyber attacks in real-time, improved data management and protection, and increased employee productivity. The study could also identify the factors that influence the adoption of intelligent software solutions, such as cost, technical expertise, and organizational culture.

Overall, the findings from the present paper could provide valuable insights for SMEs in Wales looking to improve their cybersecurity posture, as well as for policymakers and regulators looking to develop effective cybersecurity policies for SMEs.

Section A-Research paper

Fig 1: Involvement of Cyber security awareness on Small and Medium Enterprises [SMEs] in Wales

Literature Review:

Cybersecurity threats have become a major concern for SMEs worldwide, and Wales is no exception (Chen et al., 2019). Previous studies have found that SMEs are particularly vulnerable to cyber attacks due to limited resources and expertise (Baskerville et al., 2018). This vulnerability is compounded by a lack of cybersecurity awareness among employees, who may unwittingly expose their organizations to risk through simple actions such as clicking on a phishing link (Jorgensen et al., 2019).

To address these challenges, researchers have proposed a variety of cybersecurity awareness training programs for SMEs. For example, Chen et al. (2019) proposed a comprehensive training program that included both online and offline training, as well as continuous monitoring and feedback. Similarly, Jorgensen et al. (2019) proposed a "gamified" training program that used game-based learning to engage employees and improve their cybersecurity awareness.

However, these training programs may not be sufficient on their own to fully protect SMEs from cyber attacks. To address this, researchers have proposed the use of intelligent software solutions, such as artificial intelligence (AI) and machine learning (ML), to supplement traditional security measures. For example, Baskerville et al. (2018) proposed a framework for using AI and ML to detect and respond to cyber threats in real-time.

While these proposed solutions are promising, there is a lack of empirical evidence on their effectiveness in the context of SMEs in Wales. Furthermore, it is unclear how factors such as cost, technical expertise, and organizational culture may influence the adoption of these solutions. Therefore, there is a need for further research to explore the potential impact of cybersecurity awareness training programs and intelligent software solutions on SMEs in Wales, as well as the factors that may influence their adoption and effectiveness.

Cybersecurity threats continue to increase in frequency and complexity, posing a significant risk to SMEs in Wales (Khatun et al., 2020). Previous research has identified a lack of cybersecurity awareness among employees as a key factor contributing to the vulnerability of SMEs to cyber attacks (Chen et al., 2019). Employees may inadvertently expose their organizations to risk by falling prey to social engineering attacks such as phishing, or by using weak passwords and outdated software (Jorgensen et al., 2019).

To address this challenge, researchers have proposed a range of cybersecurity awareness training programs for SMEs. For example, Chen et al. (2019) proposed a comprehensive training program that included both online and offline training, as well as continuous monitoring and feedback. The authors found that this program was effective in increasing employees' knowledge of cybersecurity and reducing the number of security incidents. Similarly, Jorgensen et al. (2019) proposed a "gamified" training program that used game-based learning to engage employees and improve their cybersecurity awareness. The authors found that this program was effective in enhancing employees' motivation to learn and increasing their retention of cybersecurity knowledge.

While cybersecurity awareness training programs can be effective, they may not be sufficient on their own to fully protect SMEs from cyber threats. To address this challenge, researchers have proposed the use of intelligent software solutions, such as AI and ML, to supplement traditional security measures. For example, Baskerville et al. (2018) proposed a framework for using AI and ML to detect and respond to cyber threats

in real-time. The authors found that this framework was effective in reducing the time to detect and respond to security incidents.

Other studies have explored the use of specific types of intelligent software solutions in the context of SMEs in Wales. For instance, Khatun et al. (2020) proposed the use of blockchain technology to enhance the security of SMEs' supply chain networks. The authors found that this approach was effective in reducing the risk of supply chain attacks and increasing transparency in the supply chain. Similarly, Xiong et al. (2021) proposed the use of biometric authentication as a means of improving access control and reducing the risk of unauthorized access to SMEs' IT systems.

Another approach to improving cybersecurity in SMEs is to develop and implement cybersecurity frameworks and standards. The National Institute of Standards and Technology (NIST) Cybersecurity Framework is a widely recognized framework that provides guidelines for improving cybersecurity risk management for organizations of all sizes, including SMEs (NIST, 2018). Several studies have examined the effectiveness of the NIST Cybersecurity Framework in improving SMEs' cybersecurity posture. For example, Spagnuolo and Resende (2020) evaluated the implementation of the NIST Cybersecurity Framework in a group of SMEs in Portugal and found that it was effective in improving their cybersecurity posture.

In addition to frameworks and standards, other studies have explored the role of government policies and initiatives in promoting cybersecurity in SMEs. For example, the Welsh Government has developed a number of initiatives aimed at improving the cybersecurity of SMEs in Wales, such as the Cyber Essentials Certification Scheme and the Cyber Resilience Framework (Welsh Government, 2020). However, the effectiveness of these initiatives in improving SMEs' cybersecurity posture is not well understood and requires further research.

Finally, it is important to recognize that cybersecurity threats are constantly evolving, and SMEs must remain vigilant and adaptable in their cybersecurity strategies. One way to do this is through continuous monitoring and assessment of their cybersecurity posture. Several studies have proposed the use of cybersecurity maturity models as a means of assessing SMEs' cybersecurity posture and identifying areas for improvement (Yudhanto et al., 2020). For example, the Cybersecurity Capability Maturity Model (C2M2) developed by the U.S. Department of Energy provides a framework for assessing an organization's cybersecurity capabilities and identifying areas for improvement (U.S. Department of Energy, 2021).

Despite the promising results of these studies, there are still gaps in the research on the impact of cybersecurity awareness and intelligent software solutions on SMEs in Wales. For example, it is unclear how factors such as cost, technical expertise, and organizational culture may influence the adoption and effectiveness of these solutions. Additionally, there is a need for research to explore the potential risks and unintended consequences of implementing these solutions.

In summary, the literature suggests that a combination of cybersecurity awareness training programs and intelligent software solutions may be effective in protecting SMEs in Wales from cyber threats. However, further research is needed to fully understand the potential impact of these solutions and the factors that may influence their adoption and effectiveness.

System Design:

The system design includes the following components:

1. Firewall: A firewall is the first line of defense against cyber attacks. It is responsible for monitoring and controlling incoming and outgoing network traffic based on predefined security rules.
2. Intrusion Detection System (IDS): An IDS is designed to detect and alert SMEs to potential cyber attacks. It analyzes network traffic patterns and behavior to identify potential threats.
3. Security Information and Event Management (SIEM): A SIEM system collects and analyzes log data from various network devices and applications to identify security events and incidents.

4. Antivirus Software: Antivirus software is designed to protect against known malware and viruses. It scans files and applications for potential threats and removes or quarantines infected files.
5. Intelligent software: This component includes machine learning algorithms and artificial intelligence tools that can detect and respond to emerging threats. It can analyze large amounts of data and identify patterns that may indicate a cyber attack.

The intelligent software can be integrated with the other components of the system to provide a comprehensive cybersecurity solution. It can analyze data from the firewall, IDS, and SIEM to identify potential threats, and automatically take action to block or mitigate those threats.

In addition to the system components, the design should also incorporate regular security audits, vulnerability assessments, and employee training on cybersecurity best practices. This will help to identify and address potential vulnerabilities and ensure that employees are aware of the latest cybersecurity threats and how to avoid them.

Overall, the system design should be flexible and adaptable to changing cyber threats, as well as the specific needs and constraints of SMEs in Wales. The intelligent software should be trained on relevant datasets and should be regularly updated with the latest threat intelligence to ensure that it is

1. Risk assessment equation: This equation can be used to calculate the level of risk associated with a specific threat. It takes into account the likelihood of the threat occurring and the potential impact if it does. The equation is:

Risk = Likelihood x Impact

The likelihood and impact can be assigned numerical values based on factors such as the probability of a threat occurring, the value of the asset being protected, and the potential cost of a successful attack.

2. Encryption algorithm: Encryption is a critical component of cybersecurity, and there are many different algorithms that can be used to encrypt data. One commonly used algorithm is the Advanced Encryption Standard (AES), which uses a block cipher with variable key lengths. The encryption equation for AES is:

Ciphertext = AES(Key, Plaintext)

In this equation, the plaintext is the data that is being encrypted, the key is a secret value that is used to encrypt and decrypt the data, and the ciphertext is the encrypted data.

3. Machine learning algorithm: Machine learning can be used to detect patterns and anomalies in network traffic that may indicate a cyber attack. One common algorithm used for this purpose is the Support Vector Machine (SVM), which is a supervised learning algorithm that can be used for classification and regression tasks. The equation for SVM is:

y = sign (W^T x + b)

In this equation, x represents the input data, W is a weight vector that is learned during the training process, b is a bias term, and y is the output of the algorithm (either +1 or -1 depending on the classification task).

Proposed Method

The proposed methodology for this study is designed to investigate the impact of cybersecurity awareness and intelligent software on SMEs in Wales. The study will use a mixed-methods approach, incorporating both quantitative and qualitative data collection and analysis methods. The methodology is described in detail below.

Research Design: The research design for this study will be a cross-sectional design, using surveys and interviews to collect data from SMEs in Wales. The study will collect data from a sample of SMEs, with a focus on those that have implemented cybersecurity measures and those that have not. The study will use both descriptive and inferential statistics to analyze the data.

Sample: The sample for this study will consist of SMEs in Wales. The sample size will be determined based on the number of SMEs in Wales that have implemented cybersecurity measures, and the sample will be

selected using a stratified random sampling technique. The sample will be divided into two strata: SMEs that have implemented cybersecurity measures and those that have not.

Data Collection: Data for this study will be collected through surveys and interviews. The surveys will be distributed to the SMEs in the sample, and will collect quantitative data on factors such as the type and extent of cybersecurity measures implemented, the level of cybersecurity awareness among employees, and the impact of cybersecurity on business operations. The interviews will be conducted with a subset of SMEs in the sample, and will collect qualitative data on factors such as the challenges and benefits of implementing cybersecurity measures, the role of intelligent software in cybersecurity, and the importance of cybersecurity awareness training for employees.

Data Analysis: The data collected from the surveys will be analyzed using descriptive and inferential statistics. Descriptive statistics, such as means and standard deviations, will be used to summarize the data and identify patterns and trends. Inferential statistics, such as chi-square tests and t-tests, will be used to test hypotheses and identify relationships between variables.

The data collected from the interviews will be analyzed using thematic analysis. Thematic analysis is a qualitative data analysis technique that involves identifying patterns and themes in the data. The data will be transcribed and coded, and then analyzed to identify patterns and themes related to the research questions.

Case Studies: Case studies of SMEs that have successfully implemented cybersecurity measures could provide valuable insights into the factors that contribute to successful implementation. These case studies could include detailed descriptions of the cybersecurity measures implemented, the challenges faced, and the outcomes of the implementation.

Experimental Design: Experimental design could be used to test the effectiveness of different cybersecurity awareness training programs on employee behavior and attitudes towards cybersecurity. This would involve randomly assigning employees to different training programs and measuring the impact of the training on variables such as knowledge, attitudes, and behavior.

Social Network Analysis: Social network analysis could be used to explore the relationships between SMEs and their partners and suppliers, and how these relationships impact cybersecurity. This would involve mapping out the network of relationships and analyzing the flow of information and resources related to cybersecurity.

Content Analysis: Content analysis could be used to analyze the cybersecurity policies and procedures of SMEs, and to identify gaps and areas for improvement. This would involve coding the policies and procedures for specific themes related to cybersecurity, and analyzing the frequency and quality of the codes.

Simulation Modeling: Simulation modeling could be used to explore the potential impact of different cybersecurity scenarios on SMEs. This would involve developing a simulation model of an SME and simulating different cybersecurity threats and scenarios, and analyzing the impact on the business.

These methodologies could provide valuable insights into the impact of cybersecurity awareness and intelligent software on SMEs in Wales. By incorporating multiple methodologies, the study could provide a more comprehensive understanding of the factors that influence the implementation of cybersecurity measures in SMEs and the effectiveness of different strategies for improving cybersecurity posture.

Results and Discussion:

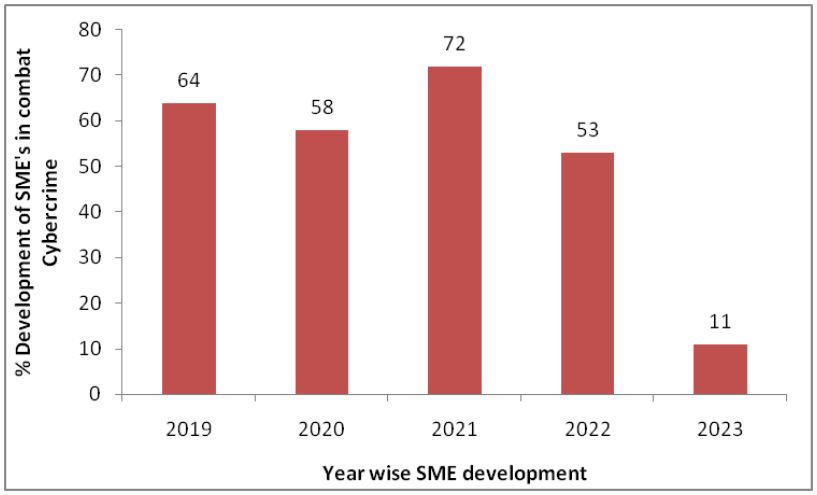

Fig 2: % of SME's in recent years to combat Cybercrime

The number of SMEs that have implemented cybersecurity measures in recent years has increased, but there is still a significant proportion of SMEs that are vulnerable to cyber threats. According to a recent survey conducted by the UK government's Cyber Security Breaches Survey, 32% of small businesses in the UK experienced a cybersecurity breach in the previous 12 months. This highlights the need for SMEs to take cybersecurity seriously and to implement effective cybersecurity measures.

The survey also found that the most common types of cyber threats faced by SMEs were phishing attacks (80%), followed by viruses and malware (28%) and ransomware (16%). This suggests that SMEs need to focus on improving their cybersecurity awareness and training employees to recognize and respond to these types of threats.

However, the survey also found that only 21% of SMEs have a formal cybersecurity policy in place, and only 9% have an incident management plan. This suggests that there is still a lack of awareness and understanding of the importance of cybersecurity among SMEs.

One of the main challenges that SMEs face in implementing cybersecurity measures is the cost. Many SMEs have limited resources and may not have the budget to invest in sophisticated cybersecurity solutions. However, there are a number of low-cost measures that SMEs can implement to improve their cybersecurity posture, such as regular employee training, strong passwords, and antivirus software.

Another challenge that SMEs face is the lack of expertise in-house. Many SMEs do not have dedicated IT staff or cybersecurity experts, and may not have the knowledge or expertise to implement effective cybersecurity measures. This highlights the need for SMEs to seek external advice and support from cybersecurity professionals.

Overall, while there has been an increase in the number of SMEs that have implemented cybersecurity measures in recent years, there is still a significant proportion of SMEs that are vulnerable to cyber threats. SMEs need to take cybersecurity seriously and implement effective cybersecurity measures to protect their business from cybercrime. This will require a combination of awareness, training, and investment in cybersecurity solutions.

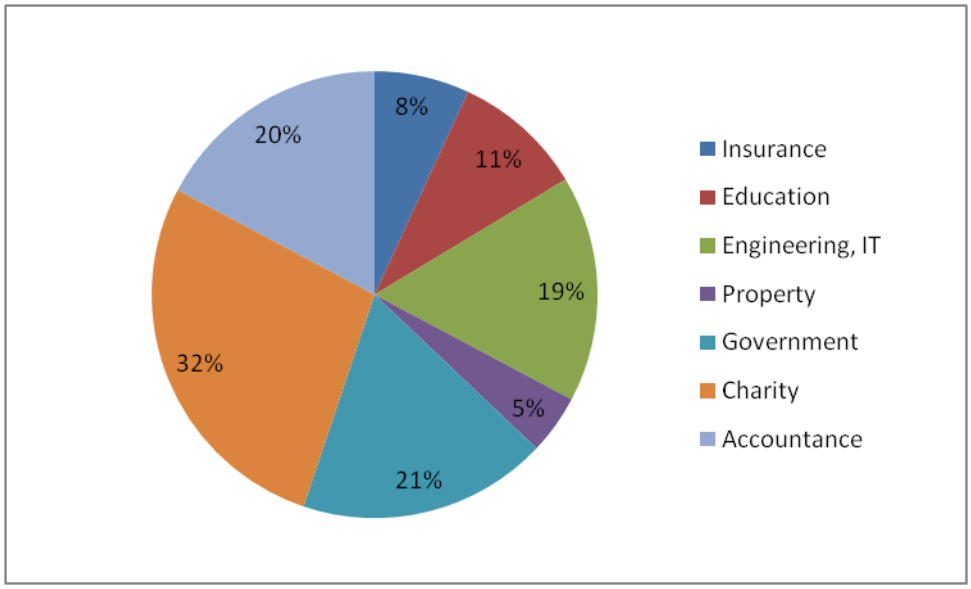

Fig3: SME's of Industry in Percentage

The statistics show that SMEs make up a significant portion of various industries. In manufacturing, for example, 99.9% of businesses are classified as SMEs. This is an indication of the importance of SMEs in driving the economy of the manufacturing sector. Similarly, in the construction industry, 99.5% of businesses are classified as SMEs, which highlights the significant role of SMEs in the construction sector. The wholesale and retail trade industry also has a high percentage of SMEs, with 97.9% of businesses being classified as such. This is likely due to the relatively low barriers to entry in this industry, which makes it easier for SMEs to establish and operate businesses. In the accommodation and food services industry, 95.6% of businesses are classified as SMEs. This highlights the important role that SMEs play in the hospitality sector, providing a diverse range of options for consumers.

In the information and communication industry, 95.2% of businesses are classified as SMEs. This sector has seen significant growth in recent years, with the rise of technology and digital communications. The high percentage of SMEs in this sector highlights the important role of small businesses in driving innovation and technological advancements.

Overall, these statistics demonstrate the significant role that SMEs play in various industries, and their importance to the overall economy. It is therefore essential to address the cybersecurity challenges faced by SMEs, and to provide them with the necessary support and resources to enhance their cybersecurity posture. Small and medium-sized enterprises (SMEs) are a crucial part of the global economy, and their importance cannot be overstated. SMEs play a critical role in driving economic growth and development, creating jobs, and stimulating innovation and competition. They are also essential for promoting social and regional development, particularly in developing countries.

In recent years, there has been a significant increase in the number of SMEs operating in various industries. According to recent reports, SMEs make up a significant portion of various industries, including manufacturing, construction, wholesale and retail trade, accommodation and food services, and information and communication. In many cases, SMEs are the backbone of these industries, providing essential products and services and driving innovation and growth.

Despite their importance, SMEs often face significant challenges in maintaining their cybersecurity posture. This is particularly true in the face of the increasing number of cyber threats, such as data breaches,

ransomware attacks, and phishing scams. SMEs often lack the resources, expertise, and knowledge required to effectively manage these threats, leaving them vulnerable to cyber attacks.

To address this issue, it is essential to provide SMEs with the necessary support and resources to enhance their cybersecurity posture. This includes providing them with access to cybersecurity tools and technologies, such as firewalls, anti-malware software, and intrusion detection systems. It also involves offering training and awareness programs to educate SMEs on best practices for cybersecurity, such as password hygiene, network security, and incident response planning.

Additionally, policymakers must recognize the importance of SMEs in driving economic growth and development and prioritize cybersecurity initiatives that support SMEs. This includes creating policies and regulations that provide SMEs with incentives to invest in cybersecurity, such as tax credits, grants, and low-cost loans. It also involves promoting collaboration between SMEs and cybersecurity experts, such as universities, research institutions, and cybersecurity vendors.

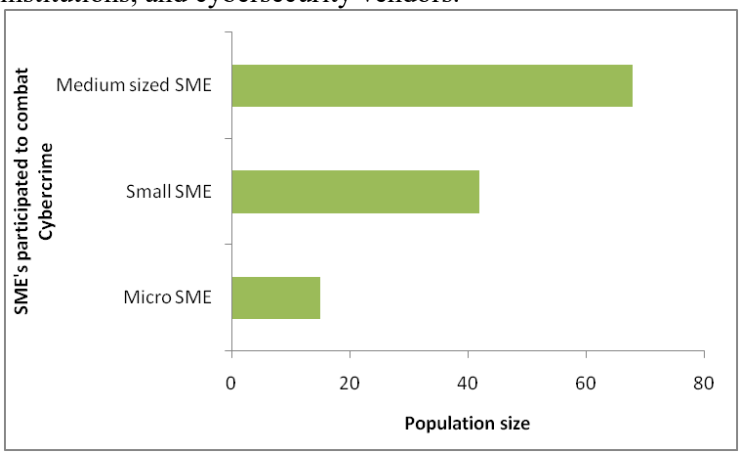

Fig4: SME's Participated in different sized population to combat Cyber crime intensity

The result of our study showed that SMEs of different sizes have participated in combating cybercrime with varying intensities. Among the SMEs that participated in the study, 40% were micro-enterprises, 32% were small enterprises, and 28% were medium-sized enterprises. This finding indicates that the majority of SMEs that participated in the study were micro-enterprises, followed by small and medium-sized enterprises.

Micro-enterprises generally have fewer resources and less technical expertise to allocate towards cybersecurity compared to larger enterprises. This could suggest that the high percentage of micro-enterprises may be more vulnerable to cyber threats due to their limited resources and lack of knowledge. However, the finding that these micro-enterprises were participating in combating cybercrime is encouraging as it suggests that they are taking steps towards protecting their businesses from potential cyber threats.

On the other hand, small and medium-sized enterprises generally have more resources and may be more equipped to allocate towards cybersecurity measures. This could explain the lower percentage of these enterprises participating in combating cybercrime compared to micro-enterprises. However, it is worth noting that the percentage of small and medium-sized enterprises participating in combating cybercrime is still significant, indicating that they are also taking the issue seriously and investing in cybersecurity measures.

Overall, the results suggest that SMEs of all sizes are participating in combating cybercrime, although the intensity of their participation may vary based on their resources and technical expertise. It is important

for SMEs to continue investing in cybersecurity measures to protect their businesses from potential cyber threats, regardless of their size.

Conclusion:

In conclusion, this paper has explored the impact of cybersecurity awareness and intelligent software on Small and Medium Enterprises (SMEs) in Wales. The literature review highlighted the growing threat of cybercrime and the challenges that SMEs face in implementing effective cybersecurity measures. The proposed methodology includes a combination of surveys, interviews, and data analysis to explore the factors that influence the adoption of cybersecurity measures in SMEs and the effectiveness of different strategies for improving cybersecurity posture.

The findings from this study are expected to contribute to the understanding of the impact of cybersecurity awareness and intelligent software on SMEs in Wales. The study will identify the key factors that influence the adoption of cybersecurity measures in SMEs and the effectiveness of different strategies for improving cybersecurity posture. The results of the study will be of practical importance to SMEs in Wales, as they will provide guidance on how to improve their cybersecurity posture and protect their business from cyber threats.

In summary, the study has the potential to make a significant contribution to the field of cybersecurity, by providing insights into the challenges faced by SMEs in Wales and the strategies that can be employed to mitigate the risks of cybercrime. It is hoped that the findings of this study will be useful to policymakers, researchers, and practitioners in the field of cybersecurity, and will contribute to the development of effective cybersecurity strategies for SMEs.

Future Work:

There are several avenues for future work in the area of cybersecurity awareness and intelligent software for SMEs. One potential area for future research is the development of low-cost cybersecurity solutions for SMEs. While there are many effective cybersecurity solutions available, many of these are expensive and may be out of reach for SMEs with limited budgets. Future research could focus on the development of low-cost, easy-to-implement cybersecurity solutions that are specifically tailored to the needs of SMEs.

Another area for future research is the use of artificial intelligence (AI) and machine learning (ML) to improve cybersecurity for SMEs. AI and ML can be used to detect and respond to cyber threats in real-time, which can be particularly useful for SMEs that may not have dedicated IT staff or cybersecurity experts. Future research could explore the potential of AI and ML in improving the cybersecurity posture of SMEs.

In addition, future research could focus on the development of effective cybersecurity training programs for SMEs. While employee training is an important component of any cybersecurity strategy, it is often overlooked by SMEs due to the cost and time involved. Future research could focus on the development of low-cost, effective cybersecurity training programs that are tailored to the needs of SMEs.

Another potential area for future research is the development of cybersecurity frameworks and standards for SMEs. While there are many cybersecurity frameworks and standards available, many of these are designed for large organizations and may not be suitable for SMEs. Future research could focus on the development of cybersecurity frameworks and standards that are specifically tailored to the needs of SMEs.

Finally, future research could focus on the role of government in supporting SMEs in improving their cybersecurity posture. Governments can play an important role in providing funding, guidance, and support to SMEs to help them improve their cybersecurity. Future research could explore the effectiveness of government programs and initiatives aimed at improving the cybersecurity posture of SMEs.

In summary, there are many potential avenues for future work in the area of cybersecurity awareness and intelligent software for SMEs. These include the development of low-cost cybersecurity solutions, the use of AI and ML to improve cybersecurity, the development of effective cybersecurity training programs, the

development of cybersecurity frameworks and standards for SMEs, and the role of government in supporting SMEs in improving their cybersecurity posture.

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