



Cyber security skill requirements from the Irish job market

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This bachelor thesis aims to do a case study on the Irish jobs market to analyze what are the most desirable skills for cybersecurity. The skills relevant to cyber security have been divided into 4 categories: technical, situational awareness, problem solving and sector specific skills. Complementary skills and traits were included in the research, but they were not a requirement from the client. The research contributes to a larger research project funded by the European commission.

A pre-defined data extraction table was used to record all relevant skills data from the job postings into predefined skills categories. The data from this table was used to create smaller more specific tables relevant to the skill category indicating the most in demand skills. The job posting site used in the research is Monster.ie. The areas where ads have been searched are cybersecurity, IT and information intensive work.

The research showed technical skill to be the most descriptive. Networking, programming and cloud computing were the top 3 most desired technical skills. For situational awareness, threat and vulnerability management and risk and impact analysis topped the list. The most important skills for problem solving were communication, working in teams and critical thinking/logical/prioritizing. Sector specific skills are not so frequently mentioned and mostly related to the health sector and familiarity with medical related technology. The most requested complementary skills and traits were documentation and presentation, project management, customer focused and a willingness to continue learning.

Keywords: Technical, situational awareness, problem solving, sector specific, complementary skills

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1 Introduction

In the ever-evolving digital work, having the necessary skills to protect yourself, your employer and their company from online threats has never been more important. Knowing what the most relevant skills are to learn and develop to help protect valuable information is what this thesis aims to discover. Attackers on the internet can target people/organizations all over the world. There are no jurisdictions with cyber-crime. Ensuring that people have the necessary skills to help defend against these attacks is what the European Commission is trying to achieve.

The European commission is conducting a project related to cyber defence. Under Horizon 2020, it is known as the European network of Cybersecurity centres and competence Hub for innovation and Operations (ECHO) project. The project's goal is to produce a practical coordinated approach to defend the European Union from cyber-attack. A network will be developed across Europe that will enable security and competence centres to communicate and function optimally. This allows for sustainable development of cybersecurity skills and in-depth testing of security products and tools e.g. early warning systems (Cordis 2021).

The research will be performed by teams that are scattered throughout Europe. The project has been broken in 6 individual areas that will be researched by different teams and will take 2-years to complete. The 6 individual areas of the project include the research and development of:

- A Multi-Sector Assessment Framework: Allows for the discovery of challenges and opportunities for sector specific needs and the needs the transverse multiple sectors.
- A Federated Cyber Range: Allows for a cyber simulation environment that can be used for R&D, training as well as certification.
- An Early Warning System: Allows for cyber-relevant information to be shared between members securely.
- A Cyber skills Framework and training curriculum: Establishes a fundamental level of required education, training and qualifications needed by sec practitioners.
- A Security Certification Scheme: Developing sector specific/inter sector security certifications allows for testing of new tech and products.
- A Governance Model: Management and optimization of the project is done through the governance model. This helps coordinate all efforts across the EU.

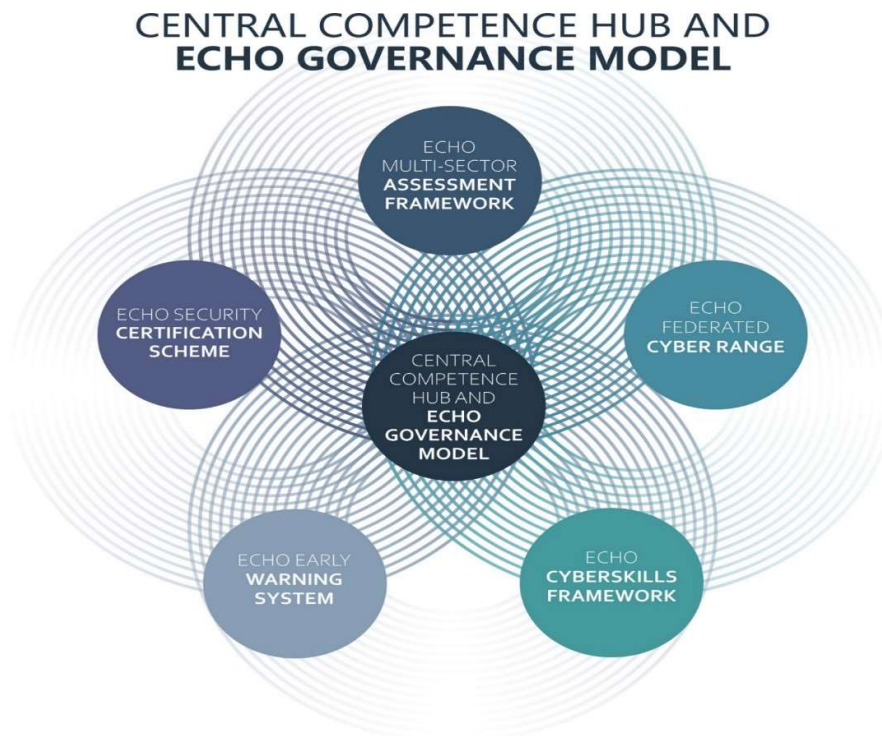


Figure 1: ECHO central competence hub and governance mode (echonetwork.eu 2021)

1.1 The objective

The research for this thesis is part of the cyber skills framework and training curriculum area of the project. The research will not directly contribute to the development of the cyber skills framework. It will, however, be part of the research that looks at the societal impact that skills or a lack of skills can have. Rios (2019), Cedefop (2016, 2018), Burner et al. (2019) provides similar reports of a skills shortage, while Enisa (2021) suggests solutions that can help close the skills gap.

The objective of this thesis is to use the Irish jobs market as a case study to discover the current skills trends needed in relation to cyber security. As part of the project, similar studies will be conducted on other jobs markets throughout Europe to assess their skill requirements. The background for the research will be discussed and clarification made in relation to the difference between skills, traits, and competencies. These all frequently fall under the same hat, especially in relation to job advertisements. The thesis will clarify what skills are relevant to technical, situational awareness, problem-solving skills, all of which are beneficial to cyber security. These skill categories were decided through research on another paper related to the ECHO project. The research searches job postings from the Irish website: Monster.ie, to help identify the currently most valued skills in cyber security, IT and information intensive jobs. The information gathered will create a list which can then be

given to the Laurea research team to help them in developing a gap analysis on the skills that are valued against the skills people have. People can then be trained with the skills from the list to comply with industry trends. This will then boost skills throughout Europe and aid in closing the skills gap.

1.2 Criteria for the research of the project

The ECHO project had guidelines that needed to be considered when recording the data. All the guidelines could be easily followed by having their own column in the data extraction table that the ECHO project officials would sign off on when finalized.

The jobs must be related to cyber security, IT, information intensive. Information intensive meaning they are not typically classed as IT jobs but still involve large amounts of data and the use of information and communication technology (ICT). The idea behind focusing on these 3 types of jobs and not just cyber security is that cyber security knowledge is needed to varying degrees for all these types of jobs. The use of ICT requires some level of security knowledge or best practices in order to stay protected. Data needs to be protected and seeing the security requirements/skills required from various job ads would be beneficial to the research.

Particular attention was paid to jobs specific to the 3 sectors: health, energy and maritime and finding a skills gap in these sectors. There is also an opportunity to discover any transversal skills between the sectors.

2 Theoretical background

2.1 E-skills and their importance

E-skills (electronic skills) are the skills needed to utilize information and communication technologies (ICT). Eurostat (2016) has defined e-skills into 3 categories. ICT practitioner skills: which involves the ability to design & plan, research, produce, consult, market, integrate & install, administer & maintain, support and service ICT systems. ICT user skills: refers to a person's ability to successfully use ICT systems and equipment. People often support their work through the use of ICT systems as their tools. These user skills typically involve the ability to use software tools and specialized tools relevant to their specific business function or industry. They have been described as covering digital literacy. e-Business skills refer to the ability to take advantage of openings created by ICT. Typically involving the use of the internet, ICT is used to boost an organization's ability to perform efficiently and effectively. These skills also allow a business to discover new alternative ways of managing their processes and even creating new business avenues.

An economies potential for growth corresponds with the skill level of its workforce. So, the development of e-skills is an essential aspect for the economy expand. The more dependent society became on digital technology the more vital these skills have become. Having good e-skills can even facilitate social inclusion in a digital society. Supporting the development of e-skills can help support the demands of emerging sectors and technologies which in turn creates jobs and develops the private sector, which overall, lets the economy grow dynamically. The more technology evolves, and newer technologies emerge the greater need there is for people with the correct e-skills. E-skills are a necessity for many jobs in the work market and even for promotion or advancement once employed (EU4Digital 2021).

2.2 Cyber security skills and their importance

The field of cyber security has received a lot of attention over the last few years, mostly due to a large number of high-profile hacks that have occurred. This would highlight a general lack of security and a lack of employees with the appropriate skills necessary to deal with these kinds of attacks. The need for e-skilled workers grew much quicker than the need for security skilled workers. Many people (hackers) realized that with the correct e-skills/knowledge they could find holes or flaws in a company's infrastructure and have complete access to all kinds of company and client data. It is widely considered that human error is one of the biggest contributors to hacks being successful. It is possible to use ICT securely and insecurely. Its not uncommon to have employees with the correct technical skills but not enough security related skill/knowledge. This means their activity can leave a company vulnerable to attack. All employees should have at least basic security knowledge. An employee is of little benefit to company if they cannot utilize ICT securely or interact with people without giving away valuable information. Many companies even conduct regular basic security training to all employees. A companies security team can occasionally send fake emails out as a way of testing employees, to see if they can spot a social engineering threat and report it.

Kaspersky (2021) says cyber security is the defense of all internet connected devices, their network the information they contain from malicious attack. The term cyber security can then be broken down into 6 different categories. Network security, application security, information security, operational security, disaster recovery and business continuity and end user education. Cyber security implies a high level of technical skills, but it requires varying levels of other skills that go beyond just technical. Skills as defined by Boyatzis & Klob (1991) are a blend of knowledge, ability and experience which enable a person to perform a task comfortably and to a high a standard. Skills are built through practice and have a specific domain, e.g. a security professional may have built various levels of skills in the 6 domains mentioned above, but to be a valued cyber security professional, other contributing skills are also required. Cyber security skills are measured by a person's technical knowledge, ability

and experience utilizing hardware and software in manner that protects information from cyber-attack (Carlton & Levy 2015).

2.3 A shortage of skills

A skills shortage has been reported on for several years now and it is a global problem. Holtz-Eakin & Lee (2019) reports a skill shortage in America lasting at least until 2029. They state that an increase in educational attainment and skills development is drastically needed to avoid a significant drop in economic output. Burner et al. (2019) report similar findings, stating the top reasons for organizations struggling to hire appropriate people in descending order as: other organizational competition, not enough work experience, not enough technical skill, low number of applicants/no interest, salary and benefits not sufficient for market, not the appropriate soft skills. Equally in Europe, Rios (2019) reports that many workers throughout Europe are either under skilled or overqualified for the jobs they are in. Adding that managerial jobs from high skilled positions in healthcare, ICT and teaching have the most skill shortages. Also suggesting that one of the biggest challenges European companies will face is a lack of skilled workers. Cedefop (2018) substantiates this by stating that 27% of employees who feel they are under skilled, are also concerned that their current skills will be outdated within 5 years. Adding that in Europe 7 out of 10 employees need at least some fundamental ICT training to do their current job efficiently.

Cedefop (2016) says that ICT professionals are among the top 5 occupations with a skills shortage. The reasons being is that not enough ICT professionals graduate to keep up with demand for a profession that is needed in every sector. Adding that in some cases the entry requirements for higher education can be high as can the dropout rates, lowering the number of graduates. It is also not uncommon for educated professionals to emigrate in search of better paying, more esteemed jobs after graduating. This leaves a country lacking in its skilled workers.

Nowadays, security skills are not only essential for professional life but because people are constantly connected to the internet through multiple devices (phones, watches, tablets etc.) and the IOT, the need for security knowledge and due diligence has never been higher. Learning to hack has become a hobby for many who wish to entire competitions online that put their skills to the test. These skills can be developed online for free through various platforms. It is now also a subject thought in schools all over the world and over the internet.

Cybersecurity as a profession has grown greatly in the last decade. There is even an increase in the number of cyber security higher education programs and their participants. However, there are still not enough skilled and qualified workers to meet the growing demand. In the next 2-3 years the number of graduates is expected to double. It is reported that it is a male dominated profession with only 20% of female students enrolled (enisa 2021). To substantiate

this need for professionals with security/hacking knowledge or skills. In June, Clare Duffy of CNN (2021) reported that globally there are over 3.12 million vacant cyber security jobs. Specifically, to Ireland where this thesis's research takes place, a similar story was reported in June by the Sun's Craig Farrell (2021) stating "IRISH employers face a dire talent shortage as 78 per cent of businesses are struggling to fill new roles". The article says that many skillsets and highly skilled workers are hard to locate. Pedley et al. (2020) reports that roughly 48% of companies have a skills gap in relation to cyber security skills. They report a technical skills gap as being large, while also informing that 29% of cyber firm's job applicants lack non-technical skills e.g. communication, leadership or management skills. This has affected achieving company goals. 28% of companies said the same problem when referring to their current employees.

2.4 Closing the skills gap

There are multiple ways to try close the skills gap related to both e-skills and cyber security skills. Many of which are underway already. In Higher Education increasing the number of programs/classes, then admissions and lastly graduates for courses relevant to these skills. Establishing a framework concerning job roles, skills, knowledge, and competencies. EU member states should collaborate to create EU funded projects that focus on skill development. Conduct regular analysis of market needs and trends that will indicate the magnitude of the problem and help create the procedures to deal with it (enisa 2021).

The research for this thesis completes a very small portion of the market analysis, by studying the current skill trends from the Irish job market.

2.5 Understanding skills

2.5.1 The difference between skills and traits

It is common practice for skills, traits, and competencies to all be considered one and the same, especially when looking at job postings. Although they are each different, they are however intertwined, where one can improve the ability to do another.

Competencies are a combination of knowledge, skill, and attitudes related to a topic. They show how competent a person is in a given field. This means they are directly related to performance, measured against standards, and can be improved with practice and training (Parry 1998).

Typically, a skill is something that is learned and developed through practice over time. A person can sometimes be born with a natural ability to perform a certain task e.g. with a musical instrument, art or sport. A person demonstrates their skill through performance. The

primary measure of skilfulness is how well a person can perform under differing circumstances (Katz 2009).

Skills are usually specific and often situational. Quite often a skill relies on several competencies. A competency can lend itself to several different skills e.g. listening is a competency used for various skills like presenting (presentation), interviewing, negotiating, conducting a meeting, sales, teaching etc. (Parry 1998).

Traits are tied to personalities and help describe and distinguish a person's qualities. E.g. Co-operative, steadfast, creative, independent, ambitious, committed, flexible, disciplined, assertive, decisive, humble, conforming to policies, initiative, team player and self-esteem are examples of traits. Traits develop at an early age; some are even inherited. As a result, they can be difficult to change. One observation is that traits many be mentioned in a job posting but once hired assessment or training of these traits will not continue. The focus or interest switches to performance/skills in a job role. It's not uncommon to see conflicting traits requested in a job posting e.g., creative and conforming or independent and a team player or committed and flexible (Parry 1998).

Brunello and Schlotter (2011) identifies skills as cognitive abilities and traits as non-cognitive. Skill or cognitive ability is recognized by intelligence and whether a person can solve abstract problems. They are typically measured through standardised tests. In accordance with the five-factor model, non-cognitive/personality traits relate to one of the following factors: agreeableness, conscientiousness, emotional stability, extraversion and autonomy or openness. Traits are often highly sought after by employers as they emphasize a good work ethic e.g. communication/interpersonal, teamwork, flexible or adaptable, initiative, honest are all examples of traits that regularly appear on job advertisements. Traits are often referred to as soft skills. Pedley et al. (2020) refers to a 2018 Study that uses the opinions of large global organizations to suggest that employees with related work experience and strong non-technical skills are believed more valuable than an employee that has obtained their degree in the appropriate subject.

3 The skills categories relevant to the study

It was decided that the skills categories that benefit cyber security the most are: Technical, situational awareness, problem solving and sector specific skills. These categories were decided based off information gathered during the completion of another unpublished paper. It is titled "Cyber skills and their acquisition in the Cybersecurity Training and Cyber-Ranges (CRs)" and was written by Aaltola, Heinonen & Ruoslahti. It is also tied to the European Commission's ECHO project. The authors conducted a questionnaire to gather information

from 43 respondents from 40 different European organizations relating to what skills are important to cyber security. The 4 categories were created during periodic progress meetings for the ECHO project. Laurea's research team on the ECHO project presented this list to the ECHO partners, who accepted it in October 2021.

3.1 Technical skills

Technical skills as the name suggests are a necessity to enter the field of information technology (IT). They can often be referred to as hard skills. Chen (2021) says that technical skills show expertise ability with specialized level knowledge that allow someone to complete complex tasks relevant to a specific field. This idea is substantiated by Katz (2009) who also says technical skills involve methods or techniques that use analytical ability within that activity and often involves the use of tools to support that activity. He also proposes that technical skills are the most sought-after skills from the jobs market. These are what people get educated in and are often what are referred to most in job titles. Most occupational training programs centre around developing technical skills. Ahmad Nabil Bin MD NASIR et al. (2011) corroborates the previous concepts on tools/equipment familiarity and education by saying that technical skills show a combination of specific knowledge and ability that have been commonly learned through higher education and developed through practice. This supports a deep understanding of the tools, equipment, and tasks relevant to that area of work.

Patacsil & Tablatin (2017) suggests that technical skills are what is used to create an educational curriculum and supports the claim that they are what employers mention in job postings when looking for new employees. They also suggest that when referring to ICT a "low skill" employment position is non-existent and that even entry level jobs in ICT can require multiple types of technical skills. As a result, even entry level skills can be enough to last a career. They state that hardware and software is developed at such a fast rate that it is not uncommon for a skills gap can occur if no effort is made to stay with current trends.

Ardian Sopa et al. (2020) indicates technical skills as being knowledge that is easily documented, thought, or learned and it represents most of the knowledge within a company. They refer to technical skills as hard skills and say that they can easily be shared amongst employees. They suggest that Technical/hard skills are cognitive in nature and may be influenced by intelligence. Stating that the results of technical skills are usually visible, and they can be assessed through practical tests.

Cash et al. (2004) supports the previous assumptions by saying that technical skills which are particularly related to information systems are knowledge and understanding to a specific domain of work. They add examples to this claim by suggesting that expertise or understanding of hardware, systems, applications, software, and programming can all fall

under the heading of technical skills. Pedley et al. (2020) research divides technical skills into 2 categories related to cyber security, Basic and advanced. Their basic technical skills include, setting up firewalls, choosing secure settings for devices or software, controlling who has access, setting up antivirus protection and keeping software up to date. They identify these as the minimum skills needed to be cyber secure. Advanced technical skills are related to security architecture or engineering, penetration testing, using threat intelligence tools, forensic analysis, interpreting malicious code or using tools to monitor user activity.

3.2 Situational awareness skills

Situational awareness as the name suggests is being aware of what ever situation you find you find yourself in. These skills lend themselves to all aspects of a person's life, for example driving, cooking, sport, working etc. Having good situational awareness is something that can be developed through experience, practice and a good understanding of the necessary processes. Resourcesregulator.nsw.gov.au (2006) says that situational awareness is considered a soft skill which means it is non-technical. They say that situational awareness is a person ability to be aware of what is always happening around them and to be situationally aware a person must listen, watch, and understand their surroundings to a point that they can predict what might happen. This allows for suitable decisions to be made to counteract/coincide with the events you expect to happen.

The paper by Graafland et al. (2014) on training situational awareness to reduce surgical errors explains that situational awareness skills are higher in more experienced surgeons, supporting the idea that these skills are developed through practice and understanding of procedures. The paper indicates that errors in the operating theatre are more commonly related to errors in judgement, negligence, or lack of understanding. It goes on to say that even though the surgeon's technical skills are high, frequent errors can occur if their situational awareness skills are low. It promotes the development of these skills through simulation training or soft skills courses. In terms of cyber security, cyber ranges would be work as a means of building these skills through simulated practice.

Champion et al. (2012) says in relation to cyber security situational awareness skills are often utilized when part of a team, and that the team needs the ability to adapt, maintain awareness, and respond to the situations as they arise. They emphasize that this becomes more complicated as the person/team rely heavily on information displayed by a computer/system. If the computer or system provides large volumed, highly detailed information, it is far more likely that this will complicate, confuse, and delay the person in making the correct decision on how best to handle the situation. The idea of using automation, using algorithms could help with large volumes of information, but this reduces

the situational awareness skills of the person. The paper supports the idea of building good communication and collaboration skills as a way of achieving good situational awareness.

Gutzwiller et al. (2020) says that situational awareness skills can be influenced by workload, stress, and even how fatigued a person is. The paper substantiates the ideas mentioned by champion et al. by saying situational awareness is important when working in active environments e.g. cyber security professionals and the teams they represent. The teams depend on shared information, understanding, and prediction. The reliance on interfaces or the command line for their work and the passing of information between the professionals and the system only complicates their ability to be situationally aware. A lack of communication or information sharing can result in poor decisions being made. The paper suggests that improving situational awareness would improve security. Since people are an important factor in cyber security, then the more aware they are, the better decisions they will make.

The paper by Pahi et al. (2017) on several situational awareness models concluded that there is no holistic approach to applying cyber situational awareness to critical infrastructures. By sharing the Information between the public and private sector it helps raise the level of cyber situational awareness. Information sharing on this scale allows for early detection and prevention of complex large-scale attacks.

3.3 Problem solving skills

Fitriani et al. (2020) states that problem-solving is a cognitive process that requires knowledge, skill, and personal experience to both identify and solve problems efficiently. They highlight curiosity as a cognitive aspect and say it is the driving force behind the problem-solving process. This is substantiated by Araiza-Alba et al. (2021) as they explain the learning process as having essential skills that fall into 3 categories, interpersonal, intrapersonal, and cognitive. Under the cognitive heading comes critical thinking, creativity, executive functioning, and problem-solving skills. They say that problem-solving is about having the ability to identify a problem, find alternative solutions, and apply the best one. They also suggest that these skills begin to be developed in childhood.

Snyder & Snyder (2008) talk about critical thinking as the logical systematic process of conceptualizing, analyzing, integrating, and assessing gathered information. They highlight Critical thinking skills as important because they enable people to handle all manner of problems and they say it is an essential part of problem solving. They suggest that critical thinking is essential for making effective decisions. Facione (2015) supports this idea by discussing a 5-step critical thinking process for problem solving known as "IDEAS" where each letter represents a step in the process. I = Identify the problem and prioritize, D = Determine important information and develop understanding, E = Enumerate options and expect

consequence, A = Assess the situation to begin decision making, S = Scrutinize the process and correct as needed.

Mourtos et al. (2004) says that problem solving is about finding the best possible solution to a problem. Unlike completing a problem-based exercise from a textbook which has only one possible answer, problem solving can involve finding several possible solutions to the problem before deciding on the most suitable one for this circumstance. They assigned problem solvers with the following attributes:

1. Eagerness to read, gathering information and define the problem.
2. Follow a process and various tactics to solve the problem.
3. Examine the problem-solving process and try to improve on its effectiveness.
4. Value accuracy over speed.
5. Write down ideas, build charts etc., to aid in solving a problem.
6. Are organized and systematic.
7. Have an open mind, are flexible, view situations from all possible angles.
8. Can use relevant subject knowledge and objectively and critically assess the quality of it.
9. Welcomes change and manages stress while handling doubt.
10. Sticks to the fundamentals rather than various memorized sample solutions.

Steiner (2021) suggests that there are various activities that can help improve a person's problem-solving skills e.g., problem based learning or project based learning (PBL), Group/team work, Practice foundations (solve low-mid difficulty level problems to get deeper understanding of strategies/solution patterns), Learning various methodologies, Guided problem solving (receiving help/guidance from a mentor or expert when progress comes to a halt), finding an alternative method that best suits the problem solver (Favoured by the more experienced person). He suggests that each method has its own set of benefits and may influence people differently so they should experience several methods before deciding which approach is best.

In the cyber security field finding and fixing problems as early as possible is key to staying secure. This means a strong technical knowledge with a deep understanding of networks is needed and the ability to analyse data with great attention to detail. The more understanding

the cyber professional has the more equipped they are to find a problem and develop a suitable solution.

3.4 Sector specific skills

Sector specific skills are particular or specialised skills that are needed in order to do certain jobs in these sectors. Some examples of sectors could be health, energy or maritime sector. These are skills additional to the technical skills etc. being researched for this thesis from the cyber security, IT and information intensive jobs. Each sector will have their own skills that are required to work in that field. For example, the health sector may require skills/knowledge and experience of working with medical or laboratory equipment or in the case of the energy sector, working with equipment related to renewable energy sources.

3.5 Complementary skills & traits

This section was not requested by the European Commission in the research for the client. However, the author gave complementary skills and traits its own column in the data extraction table after the research on skills showed how influential soft skills can be. The same can be said of complementary skills. It became worthwhile adding this information to the research, especially considering how frequently they come up in job postings.

Complementary skills are skills that are quite different but lend themselves to each other and create an overall benefit e.g., cyber security requires a lot of technical skill/understanding, but there are many other skills that can also be an advantage while working in cyber security. Project management is one of those skills. The ability to multi-task, be organized, flexible, decisive, ambitious, documentation and presentation skills can benefit a person in many different professions, not just cyber security. Additionally, 2 members of the same work team may have different skills and collaborate with each other to perform a more complex task, which means their skills complement each other.

The importance of soft skills complementing the necessary technical skills is often overlooked or underestimated e.g., common sense, and communication skills. In particular, good communication holds significant value e.g., upwards communication (communicating cyber risks to managers), and downwards communication, educating other staff on cyber security. Other valuable complementary or soft skills included attention to detail, an analytical and curious nature, an ability to spot patterns, a willingness to review their work, and an eagerness to learn new things (Pedley 2018).

4 Research Methodology

The entire ECHO projects skills research includes the whole of Europe, which is too large a scale for a bachelor's thesis. The research for this thesis is a case study of the skills that are currently in demand from the Irish jobs market. A case study is research of a group, event, or individual that involves the study of a trend in a real-life setting. It is a research strategy which can be characterized as an observed descriptive analysis of a case. Information is collected from many sources relevant to the trend. Conclusions are made by finding correlations between the gathered information (Swanborn 2010). There will be additional case studies made in relation to other European countries.

The research conducted for this thesis was quantitative, in the form of searching job postings for skills. Quantitative research is the study of numerical data relevant to topic. This allows for a more statistical analysis of the data (UTA Libraries 2021). A total of 60 job ads were chosen from the Monster.ie website between early September and late October 2021. The data collected from the job postings was recorded in a data extraction table.

Pattern matching was used for data analysis in this thesis. Pattern matching involves comparing analytically observed data with calculated theory driven data (Swanborn 2010). Skills data was collected from the job ads and put in their theorised column in the table. Patterns of skills occurrences are recorded in subsequent smaller tables relevant to each skills category on the larger table. The data shown in the tables can be used to make lists that can then be used to train people with whatever skills are immediately beneficial for employers with the hope of closing the skills gap.

Due to the speed at which technology advances and new technology is developed, these case studies would need to be completed on a somewhat regular basis in order to keep up to date with current industry trends. It has been suggested and hoped that in the future they can be done using automation, which will be far quicker and done on an even larger scale.

5 Where the data was recorded

A data extraction table was used in the job postings data recording processes. It is an excel template that was designed prior to the thesis authors involvement in the research. Laurea's research team and ECHO were involved in its development. Two separately driven student pilot studies were used to gain experience of the tables in use and to finalize its columns. The information recorded in the columns was job title, company, country, technical field (cyber security, IT, information intensive), sector (Maritime, health, energy and other) + manager/specialist and skills columns. Each of the four skills columns used in the research has a column (Technical, situational awareness, problem solving and sector specific skills). The

job ads also requested skills that did not fall under any of these four headings. During the literature review process, it was realised that traits or competencies can help improve or are needed as part of problem solving etc. So, it was beneficial to the research to create a fifth column and called it “complimentary skills & traits”. The full table with all recorded data can be found in appendices 1,2,3,4 and 5.

6 Analysis and findings

6.1 Limitations encountered acquiring the data

During the research it became clear that recording the sector and, in many cases, even knowing the name of the company looking for a new employee would be particularly difficult. This was because the vast majority of ads were placed by recruitment companies. The ads would simply say “we are working with a client who” or “our client is looking for”. In these situations, where only the title of the position is known the ads were recorded in a column marked “other”. Not having a company name tied to an ad that discusses various technology used within the company may be a security strategy or part of a policy. If an attacker knows what technology a company is utilizing, they may be able to exploit it. All cyber security jobs went into the section market “other”, while only 1 information intensive job was marked in this section. Indicating more information was provided in these ads e.g. company name or sector.

As a result, the research indicates recruitment companies are the favoured method of use for the hiring process. Nonetheless, the research was able to find 10 jobs from the health sector, 3 jobs from the energy sector, 1 from the maritime sector and 46 were marked as other.

It is unclear why exactly maritime was the most difficult sector to find Jobs matching to the criteria (cyber security, IT, Information Intensive). The 1 maritime job that was added to the research was for a container admin agent. It requested the least skills & qualifications of all the ads collected. Only a high school (or secondary school as it is called in the ad) education with good computer literacy, analytical and communication skills were requested.

Additionally, the language used in many job descriptions can be somewhat vague or general at times. For example, looking for a person with good computer literacy skills does not explain much in terms of IT skills. Does that simply mean Microsoft office skills?

It was more common when mentioning technical skills in the job ads that more detail was used. However, some ads chose to give an over general term rather than being specific. For example, one ad might say network or networking skills while another might say OSI model, protocols, firewalls, ACL (access control lists), LAN/vLAN, etc. This affects the

information gather in the research. It should also be noted that the title of the position may influence how the ad is written. This means that e.g. a network engineer or a NOC (network operations centre) specialist with several years' experience has enough networking skills without listing all the skills that are needed.

6.2 Technical skills findings

The technical skills recorded from the Job ads was unsurprisingly the largest in volume. Different ads will use varying terminology to mean the same or similar things. Table 1 below groups together relatable skills to form a list of the top 10 most requested technical skills from the job postings.

Technical Skills	Number of occurrences
Networking, Network security, Security architecture, Secure solution design	31
Programming: Sec too dev, automation, scripting, debugging, software + app dev/design, agile SW dev, software engineering, coding best practices	23
Cloud, cloud security, admin + design	22
Operating system Skills Linux, OS security	12
Operating system skills Windows, OS security	9
Server building + management (data center)	9
Using system + host monitoring tools (security tools)	8
Data structures/mining/analytics/management + tools	7
Virtualization	7
Tech support, help desk, system admin, infra	6

Table 1: Most requested technical skills

Table 1 shows network related skills are the most desired. These skills are essential to cyber security and IT. Network related skills covers a broad area, and it is possible to master some but not all areas. Some ads kept it vague in their description by saying just networking. Table 2 below shows the skills of the ads that were willing to provide more detail about the level of networking skills required.

Area of networking	Number of occurrences
Active Directory	10
Firewall	7
SIEM (security incident & event management)	6
IAM (Identity and access management), access control	5
HIDS/NIDS (Host intrusion detection system/network intrusion detection system), HIPS/NIPS (Host intrusion prevention system/Network intrusion prevention system)	3

Table 2: Most requested networking skills

In table 1 programming skills was the second most desired. When this was mentioned in the job postings the exact language was not always specified. For example, it might say programming skills or debugging or scripting or tool development etc. Software development is part of the programming section. This allowed for other additional skills/knowledge that were sometimes mentioned e.g. Agile software development methodology and secure coding practices. Saying that the code needs to work as well as not be vulnerable to exploitation or attack. A significant quantity of the ads was satisfied with stating programming skills or similar e.g. tool development or scripting, with no mention of what language would be used. This could be down to the job requirements e.g. writing scripts. The company may only be interested in the fact that the scripts work and not the language used. Table 3 below shows the types of programming languages requested and the number of times they occurred.

Programming Language	Number of occurrences
Python	6
SQL	6
JavaScript	2
C#, C++, HTML, CSS, Scala, R, JS frameworks	1

Table 3: Most requested programming languages

Table 1 shows cloud technology skills as the 3 most requested skills. Cloud is an area that is mentioned extensively. Cloud, cloud security, cloud architecture/design, cloud admin, Saas, etc. are mentioned repeatedly. 3 cloud service providers are mentioned, google twice, Azure 9 times and AWS 10 times. All these cloud service providers run certification courses for their platforms. Starting at fundamental level courses and working up through admin and advanced levels in various fields of interest e.g. security or developer or AI etc. Strong cloud skills are highly sought after, and it is entirely possible to build a strong level of technical skill and experience obtaining these certs. A person with these certs would be very employable to a company that utilizes the same platform.

As the research on skills showed, technical skills often involve the use of tools. The research on job ads confirmed this by the fact that job ads frequently request experience with applications and tools. Table 4 shows what are the most used technologies from the job postings. This shows employers not only want you to know and understand the topic/field in question but also be familiar with whatever applications/tools they use. Many different applications and tool were mentioned only once. So, only multiple mentions are shown in table 4.

App/Tool/platform	Number of occurrences
Office or Office 365	9
VMware	6
Ansible	3
Cisco	3
Terraform, Juniper, PowerBI, JIRA, Citrix, Jenkins, Palo Alto	2

Table 4: Most used applications/tools

The applications and tools listed in table 4 related to the technical skill table as follows:
Office/Office 365 = general documentation (Word/Excel/PowerPoint) + doc management.

VMware & Citrix = cloud and virtualization (virtual machines) technology.

Ansible = configuration management + app deployment tool.

Cisco & Juniper = networking/networking equipment (routers etc.).

Palo alto = cyber security (network security through firewalls + cloud).

Terraform = Cloud, infrastructure as a code tool.

PowerBI = Data analysis tool.

JIRA = Used in agile project management, allows bug tracking.

Jenkins = Software development, continuous integration.

6.3 Situational awareness skills findings

The majority of skills that are considered relatable to situational awareness come from the cyber security related job ads. This comes from needing people that can notice minor variations in normality to know when something is not right, and a possible threat or vulnerability is happening. It comes as no surprise that all the skills in this section related to identifying, evading and responding to threats, vulnerabilities and risks. Table 5 below shows

that managing threats and vulnerabilities is the most sought-after skill in situational awareness.

Situational Awareness skills	Number of occurrences
Threat, vulnerability (TTP's), Evasion strategies, Security focus/mindset	19
Security frameworks + standards + governance, IT Security, data privacy regs, best practices, compliance	15
Risk analysis and impact analysis	10
Policy, plan & strategy dev/process dev	6

Table 5: Most requested situational awareness skills

Table 5 identifies knowledge and familiarity with security frameworks, regulation, standards and best practices as the second most requested situational awareness skill. Many ads identified which standard or framework they preferred. Table 6 below shows their popularity.

Standards & frameworks	Number of occurrences
ISO27001	7
NIST	4
Other ISO's	2
NIS, ITIL	2
COBIT, ISC2 CBK,	1

Table 6: Most requested standards and frameworks

All the standards and frameworks except one can be tied to the cyber security jobs. ITIL (The Information Technology Infrastructure Library) has 2 mentions one in a cyber security job and another in an IT job.

6.4 Problem solving skills findings

Technical knowledge/skills on a topic are drastically important when trying to solve problems. In the case of this research, it has its own section, so it is not covered here. Problem-solving skills was requested 11 times as an overall general phrase. The term problem solving can be used to describe a list of skills each of which is beneficial to problem solving. It can include relevant field knowledge/understanding, process flow knowledge, prioritization, analytical, evaluation (risk assessment), prediction, decisiveness, ability to research, team building/work, creativity/innovation, dependability, and communication. However, most ads do not go into this much detail for these types of skills. Table 7 below shows what is most sought after in terms of problem solving.

Problem Solving skills	Number of occurrences
Communication, interpersonal, negotiating	42
Team, teamwork	24
Critical thinking/analytical/logical/prioritise	15
Relationship building (client+stakeholder)	4
IS consulting, change/problem management	3

Table 7: Most requested problem-solving skills

Table 7 shows good communication skills or similar were requested 42 times from 60 ads, highlighting their importance. These are essential in all positions/sectors or industries etc. Especially in terms of problem solving, good communication is essential. However, communication skills cover such a broad area that they are actually considered competencies. Communication skills is a general term used to cover a long list of skills, traits and competences e.g. good communication but in what form, in person (interpersonal), phone, e-mail etc. Communication also covers listening/active listening, nonverbal cues/body language, respect, giving & receiving feedback, clarity & explaining technical to non-technical people, asking questions, building trust, confidence/being social etc.

Teamwork is also highly regarded and in many security jobs teams work together to solve problems often passing information between them to act swiftly and accordingly. Critical thinking/analytical etc. is also commonly requested in ads and these types of skills are not only beneficial to problem solving but are considered useful in a variety of role and positions, inside and outside the field of cyber security.

6.5 Sector specific skills findings

As mentioned, the sector specific jobs had the smallest pool to work from due to a lack of information about the company and as such the sector. The health sector was by far most advertised and the skills relevant to it were based on healthcare equipment from labs or products and having admin type skills to use them. Health data familiarity was also mentioned in relation to analytics and lab info management. Familiarity with clinical trials understanding data structures and statistics. From the energy sector skills mentioned included technical energy sector skills and understanding how to reduce energy consumption and using renewable energy sources. These skills could be covered depending on the education the job seeker holds e.g. a degree in environmental sciences and a masters in bio sciences are two that were requested from the job postings. Table 8 below shows the sector specific skills most frequently requested.

Sector specific skills	Number of occurrences
Healthcare industry analytics + domain data knowledge	3
Admin Lab instruments, systems backup, information management systems	2
Medical device experience & product dev, Installation qualifications, Operational qualifications	2
Technical experience from energy sector, reducing energy consumption, renewable energy sources	2

Table 8: Most Requested sector specific skills

6.6 Complementary skills and traits findings

Topping out the list of complementary skills and traits shown in table 9 below is documentation and presentation skills. There is an argument that these could be considered

part of communication skills. The ability to explain or show clarity to people in a working environment is so important. Project management was second most requested. This could be in the form of the ability to manage not only one, but multiple projects at once or to be able to work on team projects and remained dedicated to individual work and tasks simultaneously. Customer focused was the third most requested and this too is helped by good communication skills among other competencies and traits. The willingness/eagerness to keep learning was mentioned in 8 ads. Its importance is realised in how quickly technology evolves or new technology is developed. This is particularly important the in relation to cyber security, where not being up to date can lead to exploitation.

Complementary skills & traits	Number of occurrences
Documentation/presentation	12
Project management (PM), organized, security PM	10
Customer focused	9
Willing to learn new things/stay up to date	8
fast paced environment/under pressure	7
Own initiative/responsible	4

Table 9: Most requested complementary skills & traits

6.7 Additional findings

It is also worth noting that many ads requested a degree and even additional certification. Although these are not actually skills, having a degree or cert does indicate that the person has a certain level of skill and is competent to work in a field relevant to the degree or certification e.g. a degree in information security suggests a person has skills in keeping information secure or a penetration testing cert implies that a person is skilful in finding holes or weaknesses in an IT system. So, as no specific skill is mentioned, this information was not added to the data extraction table developed by the beneficiary of this research. However, this information does show what study and training information would build relevant technical skills in certain fields based off educational curriculum. Table 10 below shows only degree information that was recorded more than once.

Degree	Number of occurrences
Information Technology or Information Systems	17
Relevant IT/qualifications or 3 rd level education	9
Computer Science	8
Engineering	6
Information Security	4
Information Management	2

Table 10: Most requested degrees

Table 10 shows that in Ireland a degree in information technology or information systems is by far the most requested. Interestingly in a study on 60 ads, 30 of which are cyber security related only 4 ads requested a degree with the word “security” in the title. 9 ads were not even specific about the degree they wanted. They simply stated a relevant IT qualification or 3rd level education (college) that would support the role being advertised. This indicates that a variety of degrees could be suitable for their positions.

Certificates	Number of occurrences
CISSP (Certified Information Systems Security Professional)	10
CISA (Certified Information Systems Auditor)	5
Microsoft Certs	4
CISM (Certified Information Security Manager)	4
CCNP (Cisco Certified Network Professional)	3
SSCP (Systems Security Certified Practitioner)	3
CCNA, OSWE, GPEN, any Info sec, CCIE, CRISC, CEH	2

Table 11: Most requested certs

Table 11 shows us that in Ireland the CISSP (Certified Information Systems Security Professional) is the most valuable cert. Aside from Microsoft that have a variety of certs for Azure, MS 365, Dynamics 365 and Power Platform, all other certs mentioned are either specifically Security or network related. Multiple certs appear to be requested frequently and in some cases without the mention of a 3rd level education. Certs indicate a trusted, high level of technical skill in a chosen field.

Experience is another area not covered in the data extraction table, but it is so frequently mentioned in the job postings. In the research on skills, it was concluded that skills are learned and developed through time. This indicates that a person with many year's experience would have more skill than a person with very little experience. 3 & 5 years are the most frequently requested amount of experience from the job ads in terms of position held. Experience is also used a lot in terms of familiarity with tools or programs, "experience with Office 365/Ansible/Cisco/VMware" or "experience in cloud environment" or "experience with networking and Linux environments".

6.8 Summary of findings

The following figures 2-5 show column charts indicating the top 3-4 skills from each skills category. The number on the vertical axis (0-60) represent the number of ads. The number in the columns showing the number of times they occurred from the 60 ads.

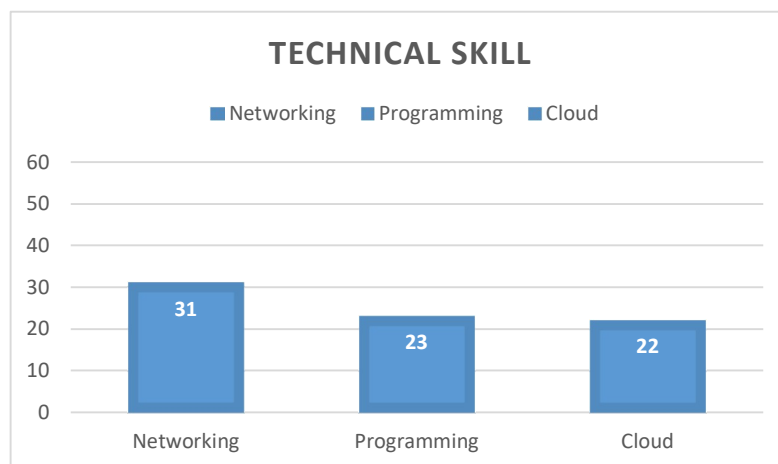


Figure 2: Top technical skills

Figure 2 shows networking, programming and cloud as the top 3 technical skills that occurred in the Irish job ads. Networking is the clear favourite and includes network design, network security network management etc. Networking skills are also valued outside of cyber security.

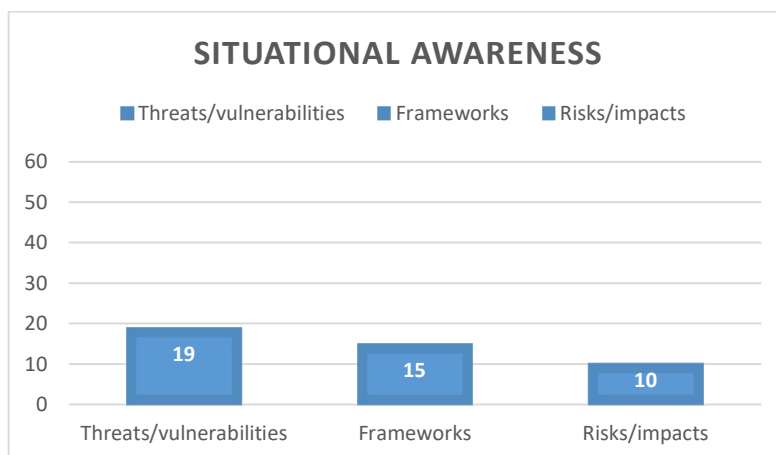


Figure 3: Top situational awareness skills

Figure 3 shows skill related to threats and vulnerabilities, frameworks and risk & impact analysis skills as the top 3 situational awareness skills. Threats and vulnerabilities skills is favoured most. This refers to skills in relation to finding and avoiding threats. Good understanding is needed to know to what out for and to know what steps are needed to avoid these situations.

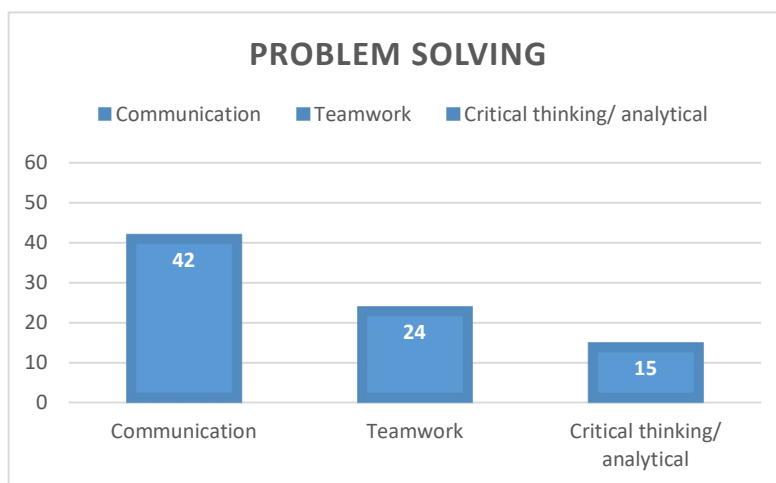


Figure 4: Top problem-solving skills

Figure 4 show that communication, teamwork and critical thinking/analytical are the top 3 skills related to problem solving. Communication is the most favoured skills in problem solving and also the most favoured skill in the whole study. It is a key skill for any role in any sector.

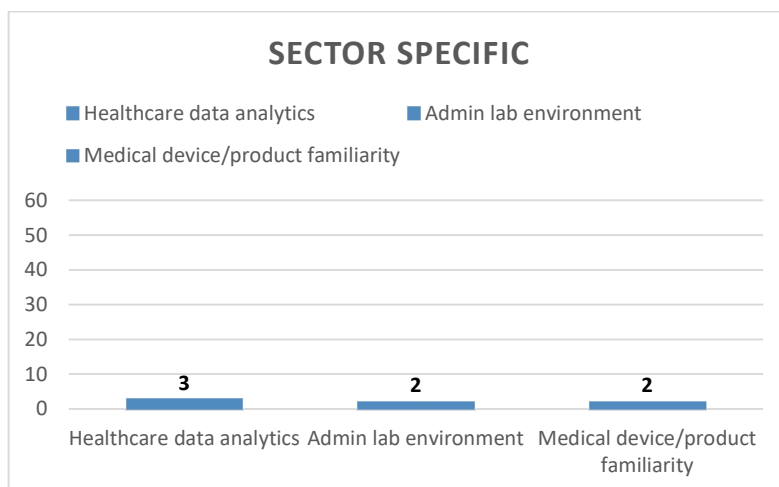


Figure 5: Top sector specific skills

Figure 5 shows healthcare data analytics, admin laboratory environment, medical device/product development and operational skills are the most desirable skills in sector specific. The numbers here are low due to many ads not saying a company name let alone an industry/sector. The health sector is easiest to track, and the skills research suggests medical device and medical data management are the best to have.

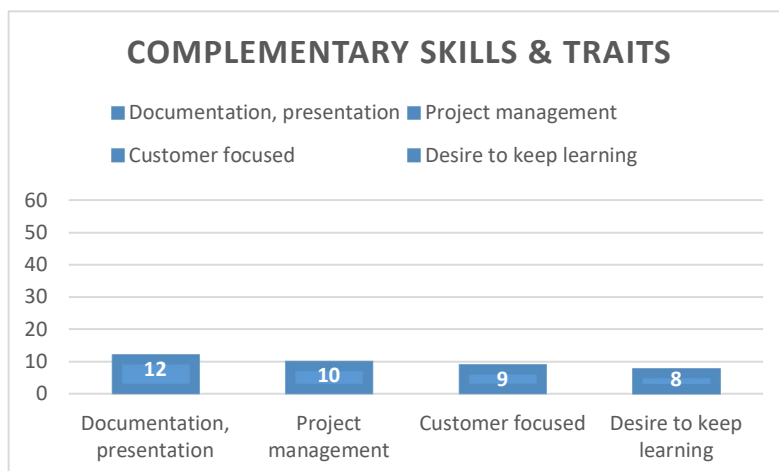


Figure 6: Top complementary skills & traits

Figure 6 indicates documentation/presentation, project management, customer focused and a willingness to continue learning are the 4 most wanted complementary skills and traits. Documentation & presentation are the most favoured and these could be considered an extension of communication.

Figures 5-6 show the top skills in each skills category. These charts paint a picture of what skills the ideal cyber security worker should have. Just including the top skills from each category, they should have strong networking skills. Both design and implementation/management which includes security best practices is needed. They should be aware of threats & vulnerabilities and how to find and mitigate them. Their communication skills should be excellent to peers, manager, customers and stakeholder alike. This includes explaining technical scenarios to non-technical people or teaching others. They need to be able to clarify themselves. Their documentation and presentation skills should be outstanding. If the position is related to a certain sector, they should be familiar with relevant technology and data management skills from that sector.

Additionally, if they have any of the 2nd or 3rd most requested skills, it only enhances their suitability. For example, if they are familiar enough with programming that they can write scripts or create security tools. If they are also familiar with and understand cloud technology. If they are familiar with specific frameworks and capable of creating plans to avoid risk. If they can work independently and as part of a team and approach problems analytically with critical thinking. If they have strong project management skills which can include managing several projects at once. If they have an exceptional ability to deal with customers and if they have a desire to continue learning all throughout their career.

7 Conclusion

This thesis aimed at finding the most desirable cyber security related skills from the Irish jobs market. This is a way of knowing the most relevant skills to train people with and to help close the skills gap. Using quantitative research, it can be concluded that in the area of technical skills, networking skills: network design, implementation & management, network security is the most sought after with slightly over 51% of ads mentioning it. Coming in second and third in technical skill was programming and cloud technology which were requested in 38% and 36% of ads respectively.

For situational awareness skills the research showed that 31% of ads favoured threat and vulnerability skills (finding and avoiding threats) the most. Knowledge of frameworks and standards was next with 25% of ads requesting certain ones (ISO 27001 being the most popular). Risk and impact analysis skills were next with almost 17% of ads wanting them.

The problem-solving skills research showed that communication was the most sought after of all skills in all categories with 70% of ads mentioning it. The next highest in problem solving was team working skills with 40% of ads requesting it and critical thinking, analytical/logical, prioritisation was next with 25% of ads wanting it.

In sector specific the numbers were low due to a lack of sector and company information in the job ads. The research revealed that 5% of ads wanted experience with managing healthcare data. While 3.3% of ads wanted experience and admin skills related to a lab environment and the same 3.3% wanted medical device familiarity including product development with installation and operational qualifications.

For complementary skills and traits, the research showed that documentation and presentation skills were highly regarded with 20% of ads wanted them. Project management was next with almost 17% of ads requesting it. Customer focused had 15% of requests and the desire to continue learning had 13.3% of ads mention it.

The research highlighted that the 3 skills categories being research as most relevant to cyber security: technical, situational awareness and problem-solving skills are all inter linked. Technical knowledge is needed to solve problems and likewise to understand what can happen when certain events occur (situational awareness). Although hard or technical skills are in high regard the research shows the importance of soft skills also. Situational awareness and problem solving require soft skills or traits as much as technical knowledge. This is most evident with communication, which is considered a competency, and is required for all types of jobs (technical and otherwise) and positions (managerial and otherwise).

Additionally, the research shows how much experience matters. Many ads in the research used multiple sentences that start with “experience in” or “experience with”. Even with a degree or cert, experience is highly sought after. It can be in the form of a role/position or with familiarity with certain technology. The more experience a person has with technology the more skilful they are. The more experience a person has with various situations the more aware they are and know what to look out for and expect. The more experience a person has with problems the better prepared they are to solve them. Experience is best gained by doing.

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Appendix 3: Jobs 31-42 recorded in the data extraction table

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2	Adno.	Job	Company	Country	Technical Field	Machine	Hardware	Energy	Other	Technical	Strategic Awareness	Problem Solving	Sector specific skill	Competency skills & traits				
31		Systems Administrator	Recruitment company	Ireland	IT					MS server/OS, Virtualisation (Hypervisor), SQL, Office 365 & Teams admin, Azure admin, Backup/Imaging Servers, Monitoring, MS AD Data backup, SQL, Scoping (powershell), AWS, S3 & IIS		troubleshooting & analytical (problem solving), Team, Communication,		Customer focus, own initiative, Documentation, Flexible				
32		Senior Infrastructure Administrator - Windows & Data centre	Recruitment company	Ireland	IT					hardware & config data centres, Data centre + server maintenance, Patching Linux, Monitoring, AD admin, Cloud (AWS/S3/AZ), Virtualisation (VMware), system monitoring	Virtualisation/infrastructure	Critical thinking, Communication, Teams, self motivated		Documentation, maintain up to date knowledge, responsible				
33		Network Engineer	Recruitment company	Ireland	IT					Monitoring, Firewalls, LAN, VLAN, VDI, Mobile web 4G & 5G, Network Security	Strategy creation on network improvement	Communication, Team, Analytical, problem solving (network based)						
34		IT Laboratory System Administrator	Recruitment company	Ireland	IT					IT hardware & monitoring, Access management, GPO, OAD, Document management systems, Symptom manager, IAMS, LACIE,	Clear SOP's		Admin on Lab instruments, Lab systems backup admin, Pharmaceutical scanning devices, Installation qualifications, Operational qualifications					
35		IT Systems Administrator	Recruitment company	Ireland	IT					Sys Admin, AD & exchange servers, Virtualisation		Communication/interpersonal, strong problem solving		Quick learner, organised, work under pressure, multi-project management				
36		Network & Systems Administrator	Recruitment company	Ireland	IT					Test support/patches, Vendor/clients servers, AD, O365, Backup + IDS, Antivirus, Firewall, Networking, MFD support,		Analytical, problem solving, Communication/strong relationship management		Multitask/multi-project, customer focus, continued learning				
37		NOC Engineer	Recruitment company	Ireland	IT					NOC, Networking, Telsco, Juniper, Cisco		Communication, Team, troubleshooting						
38		Business Systems Analyst	Legato health technology	Ireland	IT					Data analysis - mapping - mapping - visualisation, SQL, API/platform, Data structures (query - compare)	Process development/documentation	Communication, team, analytical	Healthcare industry analytical domain data knowledge	Documentation/presentation				
39		Senior Solution Architect	Recruitment company	Ireland	IT					IT architecture/Design with security in mind, Cloud, SaaS, O365, SaaS, CoE/HF, PowerBI, Power Apps, QM, Microsoft, Trigenix, Salesforce	Security mindset	Communication, Team, self-starter		PM, work under pressure, initiative management, qualified (team, stakeholder, people)				
40		QA/IT Specialist	Project Management company	Ireland	IT					Data/IT, PLC programmable logic controller, SCADA (Supervision control and data acquisition), DSRP, PAS-X, System & quality review	Risk assessment	Communication, team	Industry regulations & standards, CSy in pharma industry	PM				
41		IT Application Manager	Recruitment company	Ireland	IT					Cloud SaaS, IT management through change, Data & modern tech knowledge		Communication, Initiative/proactive change management, Team, Problem solver, motivated		PM, customer focus				
42		Technical Services Manager	Evos Technology Group/Ireland	Ireland	IT					Strong technical skills (ICT monitoring), commercial	ITIL	Team, Service delivery management (incident and change management), communication		Fast learner, Documentation				

Appendix 4: Jobs 43-53 recorded in the data extraction table

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R		
2	Adno.	Job	Company	Country	Technical Field	Specialist	Machine	Healthcare	Energy	Other								Skills	Sector specific skill	
3					Strategic/IT/Systems/Marketing/Operations	IT/Systems/Marketing/Operations														
43		SQL server DBA	Recruitment company	Ireland	IT															Complementary skills & traits Keep to deadlines, documentation, fast paced environment
44		Senior Cloud Engineer - Healthcare	Recruitment company	Ireland	IT															customer focus/service delivery, able to demanding environment/pressure, initiative, patience
45		Infrastructure Engineer	Recruitment company	Ireland	IT															
46		Senior Technical Support Analyst	Recruitment company	Ireland	IT															
47		IS Technician/IT Specialist	CVet Solutions	Ireland	IT															Documentation, Customer focus.
48		Senior Systems Administrator	Recruitment company	Ireland	IT															
49		IT Systems Administrator	Recruitment company	Ireland	IT															Fast paced environment.
50		Software Application Engineer	Recruitment company	Ireland	IT															
51		Project Engineer	Recruitment company	Ireland	Information intensive															
52		Senior R&D Engineer	Recruitment company	Ireland	Information intensive															
53		Biomedical/Healthcare scientist	MacGen Biotech	Ireland	Information intensive															Research documentation

Appendix 5: Jobs 54-60 recorded in the data extraction table

1	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
2	Adno.	Job	Company	Country	Technical Field	Machine Learning	Healthcare	Energy	Other	Technical	Situational Awareness	Problem solving	Sector specific skill	Complementary skills & traits				
3					Strategic/Marketing/Sales/Supply Chain/Finance													
54		Senior Data Scientist - Utilities	Recruitment company	Ireland	Information intensive					SQL, Python, MS Power BI, Cloud (Datadog, Azure, AWS, Google), Adobe analytics, Business & customer analytics, analytic tools, machine learning								
57		Container Admin Agent	Dodge Shipping Group	Ireland	Information intensive	x				Good Computer literacy skills		Analytical Communication						
56		Product Manager	Harvey Nash Ireland	Ireland	Information intensive			x		Product management, Cloud (SaaS), Software (B2 Market Office)		Communication, Prioritise attention to detail		Presentation, customer focus				
57		Senior Data Scientist	Recruitment company	Ireland	Information intensive		x			AI + Machine learning, implementing deep learning applications, Python, Hadoop stack (Apache Spark, MapReduce), Natural language processing, AWS stack, ML		Healthcare sector experience						
58		Energy Engineer/Energy Consultant	Recruitment company	Ireland	Information intensive			x		MS Office		Self-motivated	understanding of reducing energy consumption, renewable energy sources	organised				
59		Business System Data Analyst - New Team - Data Mapping/Installation/SQL	Legato Health Technologies	Ireland	Information intensive		x			Data analytics/mapping etc., Technical solution design, JIRA		Communication	Analytical experience in healthcare field	Agile - S/Scrum				
60		Senior BioStatistician	Recruitment company	Ireland	Information intensive		x			Data analysing/testing etc., software (tools) Python, Spark/Hadoop, Cloud AWS		Communication	Clinical trial knowledge + data architecture + Statistical expertise	Presentation, PM				