# Development of Examination Framework for Cyber Security Professional Competency Certification

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## ARTICLE INFO

## ABSTRACT

**Talent development in the area of cyber security rapidly evolve due to the dramatic changes in cyber threats and attacks. The needs of professional certification in cybersecurity industry have been addressed by many organizations throughout the world. It was reported by many sources, there is an exponential growth in the demand for cybersecurity professional and special treatment for employee with professional certification. Malaysia encouraged cybersecurity graduates to obtain professional certification for better employment. Malaysia Higher Education Blueprint stated that future ready curriculum includes certificate ready academic program. It is believed that this model can increase competency, knowledge and skills among university graduates. Therefore, rapid growth of cybersecurity professional examinations at the global level which are product-oriented scheme can be seen. There were limited studies that explored the advantages in obtaining certified cybersecurity professional. To our knowledge, none of the previous research shared the best practices for assessment procedure in professional cybersecurity competency modules. This article presents the method in handling examination for Cybersecurity Professional Examination by adopting ISMS generic pillars known as People, Process and Technology. Our framework consists five (5) main components structured in a loop. The five modules are examination question development, examination system, examination conduct, results coordination and manuscript management. As a conclusion, professional examinations must undergo a proper process to make sure it complies with international standards and penetrate the global market.**

## I. INTRODUCTION

Competent-based education has gained attention recently. This is due to the demand for high skilled workers in many countries around the world. High skilled workers can be measured through experience, career profile, educations and certification received [3]. Cybersecurity professionals is referred to a person who works in cybersecurity industries and certified to special area in security and related field. To be certified, the person is required to sit for professional exam which is totally different from formal bachelor's degree education. Many studies were conducted to investigate the best model for assessing skills and knowledge in the areas of medical and health but none of the studies explore the methods used to assess skills in cybersecurity. This article presents a framework for conducting assessment for cybersecurity professional competency. It is structured in five sections which covers related work, methodology, implementation, discussion and conclusion.

## II. RELATED WORK

The Certified Information Systems Security Professional (CISSP) that is currently organized by $ISC^2$ originated from Hongkong. Meanwhile the Computing Technology Industry Association (CompTIA) is a company introduced computer security professional examination with the emphasis on network and awareness. Cisco security focus on Cisco products and the very recent technology.

The Global ACE scheme does not rely on product; it addressed four main components: people, process, procedure and technology.

## III. METHODOLOGY

The Information Security Management System(ISMS) has three pillars which are people, process and technology. To be robust, information security implementers and practitioners will make sure the system used complies with the requirements of the International Organization for Standardization (ISO) standards.

Framework development comprises four major process structured in a loop: first **Examination Setting**, second **Examination Question Development**, third **Examination System & Development & Maintenance, fourth results coordination. The final module is Manuscript** management which includes **disposal & archive**. Each module is built with a working process. Figure 1.0. depicts the process flow for examination for professional certification.
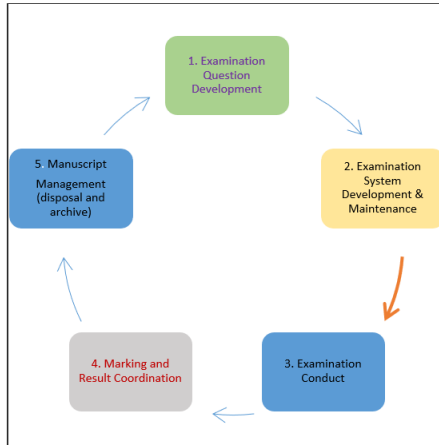
Fig 1.0. Professional Examination Framework –
the Global ACE Scheme

We developed a few important entities in module one i.e., examination setting. The entities are people, process and technology. People are the committee for examination management. The process and policy cover operational flow for the exam and technology refers to system used for the examination centre.

## A. Mapping Component

The ISMS pillars comprise of people, process and technology [1]. In our framework, we defined people as the governance authority that is designed to control the quality of the professional certification and sets directions. Under process, our framework classified all modules as the process that are required to execute the examination plan. Technology refers to system. Our examination system is online, intelligent and interactive. The following sub section explain each component with its respective roles.

## B. People

Several committees are involved in the people component of the pillar. They are: Board of Governance, Professional Examination Committee, Course Development Committee and the Subject Matter Expert (SME). All committees are assigned with special terms of reference. Examination secretariates are responsible to administer the overall process in the framework.

The Professional Examination Committee (PEC) is responsible for the governance of the examination process framework from the start to the end. The Board of Governance (BOG) is responsible for the overall process and issues in the scheme. The BOG has the full power to award certificates to the candidates who passed the examination. The third committee is the Course Development Committee, which is a working group that develops training content. This committee is important as a point of reference to the question developers. A Subject Matter Expert (SME) is an individual or group that is assigned to develop the examination questions.

## C. Process and Policy

This part addresses operational issue which starts with examination manual development, call for questions, question development, vetting, compliance audit and results & appeal. The process is complied with standards ISO17024:2012 Conformity assessment — General

requirements for bodies operating certification of persons.

What make it different with normal examination procedure is that, the question development must comply with competency examination standards. The failure to follow the standards will result in non-compliance with certification and competency.

The professional examination should align with three components in the competency model i.e., knowledge, skill and attitude (KSA).

### D. Technology

The examination is conducted online at an examination centre appointed by an authorized body. One of the criteria is that the centre is able to provide a room that has computers that can run the examination portal. The Education Management System for professional examination competency scheme must be equipped with modules that automates operations set for conducting examination. These include questions bank, random function, marking facilities and result analysis. Intelligent elements must be embedded in all functions. In addition, the system needs to be highly secured.

## IV. IMPLEMENTATION

The proposed framework implemented under the professional cybersecurity competency scheme named as Global Accredited Cybersecurity Education Certification Scheme or Global ACE Certification Scheme. The Scheme was developed by CyberSecurity Malaysia and supported by industries and academics in related fields.

The scheme provides professional cybersecurity training in three levels: fundamental, intermediate and specialisation and professional certification. The certification shall be awarded to the candidates who passed the respective professional certification examination.

### A. Question Development

The professional examination framework was implemented to the scheme since 2016. Each scheme requires examination and call for questions for each scheme are given to a dedicated group termed as Subject Matter Experts or (SME). Each module is executed with the standard operating procedures and governed by the Professional Examination Committee (PEC).

The continuous quality of improvement for overall examinations process which covered the scripts for questions, the process and results approval must comply with the professional examination standard controlled by the Quality Committee.

A call for questions script is requested quarterly. All subject matter experts presented their proposed scripts for questions irrespective to scheme. Vetting process will be conducted consequently, and selected questions will be transferred to a question bank. All questions must go through a vetting process to make sure it

complies with the KSA descriptor. The question developer has to make sure all requirements are fulfilled before submission.

The Professional Examination Committee are also responsible for examination system. The system is controlled by examination centre authorized by Cybersecurity Malaysia. All criteria are set by Cybersecurity Malaysia and the Board of Governance (BoG) of the scheme. Any organization or company could apply to be an examination centre if they fulfilled the required criteria. Cybersecurity Malaysia may withdraw the appointment as examination centre to any authorized centre with valid reasons. All regulations are documented in the Examination SOP.

## B. Examination Conduct

The examination system allows all candidate to seat for online session. The multiple-choice questions are inserted to question bank and the system executed on the examination day. The examination centre will provide an examination hall which consists of controlled computers connected to protected examination portal. Candidates are asked to enter the examination laboratory fifteen minutes before Global Accredited Cybersecurity Education examination starts. User login and password are used as the control mechanism. Once login the candidate can only access the examination portal and all other applications are locked. Candidate are asked to read questions and select best answer from lists of options. It is a multiple-choice question. Once the

candidates completed the examination, they can leave the hall and the results will be released approximately two weeks after the examination.

## C. Results and Appeal

The result is generated by the system and only can be released after being approved by the Professional Examination Committee. Those who failed in the examination can apply for appeal in the next session.

The final process is archive. All used questions are not allowed to be reused or recycled. Within certain period the questions need to be removed from the system and it is termed as archive.

## V. DISCUSSION

Cybersecurity competency is in demand. Professional certification in cybersecurity which available in the market are mostly product oriented. The complete process of certification consists of four major operations which are **membership, training, examination and certification award.** Certifications are categorized according to three levels: foundation, intermediate and advanced. Each level has different types of competencies which comprises of knowledge, skill and attitude.

## VI. CONCLUSION

The Global ACE Scheme framework are mapped with the pillars in ISMS which are people, process and technology. The proposed

examination framework is aligned with Competent Based Education model (CBE) that are widely used for technical and vocational education (TVET).

This study presented best the practice in establishing professional certification for cybersecurity to support industry need and competent based education towards future-proof curriculum. The framework complies with ISO 17024 and it brings the GLOBAL ACE scheme accepted worldwide.

This article brings insightful information for practitioners and educators who is going to develop cybersecurity competency certification.

## VII. ACKNOWLEDGEMENT

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