GLOBAL CLINICAL ENGINEERING ALLIANCE™

NOVEMBER 10
7:00-8:00 PM UTC

WEBINAR

What are the Clinical Engineering activities worldwide (BoP), and the needed knowledge (BoK), to perform them

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*BoP: Body of Practice
*BoK: Body of Knowledge

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Analyzing the American College of Clinical Engineering (ACCE) – Body of Knowledge Survey

Frank Painter, MS, CCE -University of Connecticut, ACCE, GCEA– IFMBE/CED

History of the Body of Knowledge Survey - Overview

As CE profession changes, results of the survey are:

- Used to track the changes in CE Practice
- Used to shape the CCE exam
- Used to guide CE educational Programs
- Used to adjust CE job descriptions

History of the American College of Clinical Engineering and CE Certification

AAMI (Assoc. for the Advancement of Med. Instrumtn.) formed in 1965

CE certification (CCE) started in the US by AAMI in 1972

ACCE Formed in 1991

AAMI suspended CE certification program 1999

ACCE starts new CE certification program in 2002

ACCE's CE Certification Program

Certification was identified as an important component of any profession

Distribution of certification questions must be based on the current CE Body of Knowledge of practicing CEs

Previous question distributions in the CCE & CBET exams were based on opinion

BOK survey was needed to quantify what CEs needed to know and what they were doing in their jobs.

CE Body of Knowledge Survey

- The survey measured Body of Knowledge and Body of Practice.
- For simplicity, it was called a Body of Knowledge Survey
- It needed to be scientifically derived and statistically significant to be valid.
- Since the practice of clinical engineering changes over time, the survey needed to be conducted periodically

Changes in the BoK / BoP

- The CE practice changes as:
  - Healthcare changes
  - Technology changes
  - Codes and Standards change
  - Standards of care
- Surveys conducted in:
  - 2001, 2005, 2010, 2015, 2018, 2021

Questions on the Survey

Example Knowledge Questions

technologies you focus on?

- General medical equipment
- Physiological monitoring
- Surgical equipment
- X-ray equipment
- Radiation therapy equipment
- Clinical Laboratory equipment

Example Practice Questions

% of time in?

- Overall program management
- Product selection
- Incident investigation
- CMMS administration
- User training
- Regulatory compliance

Major Category Contents

TECHNOLOGY MANAGEMENT:

Technology assessment, Usability / Compatibility assessment, Product / vendor selection , Device integration planning, Life cycle analysis, Device / system upgrade planning, Return on investment (ROI) analysis, Healthcare technology strategic planning, Clinical trials management (non-investigational), Capital planning, Project management, Electromagnetic Interference (EMI) / Radio Frequency Interference (RFI) management , Clinical devices use and/or application, Pre-Clinical procedure set-up / testing, Water quality management, Interpretation of codes and standards, Other technology management responsibilities.

Category Contents

SERVICE DELIVERY MANAGEMENT:

Technician / service supervision, Service contract management, Equipment repair and maintenance, Equipment acceptance, Equipment performance testing, Develop test / calibration / maintenance procedures, Maintenance software (CMMS) Administration, Parts/ supplies purchase and/or inventory management, Technical library / service manuals management, Other service delivery responsibilities.

BoK/BoP Survey Results

CATAGORIES	2005	2010	2015	2018	Current
Technology Management	26	32	31	28	35
Service Delivery Management	19	17	20	19	20
Prod Development	8	5	5	5	5
IT/Telecom	8	8	8	10	10
Education of others	9	10	8	9	5
Facilities Mgt	5	5	6	5	5
Risk Mgt/Safety	10	11	11	10	10
General management	16	11	14	13	10

Summary of BoK/BoP Survey Results - 2002 to 2018

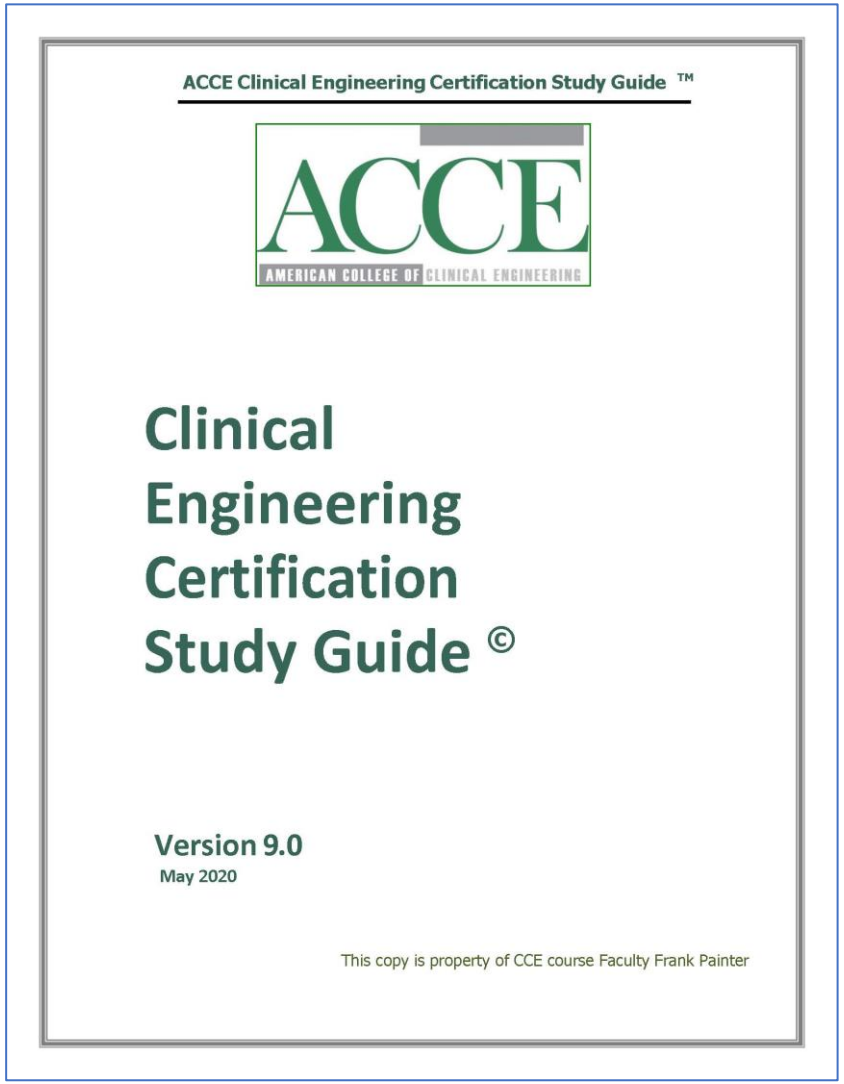
- Technology management responsibilities have *increased* slightly
- Service delivery management has remained the same
- IT focused responsibilities have *increased*
- Risk management has stayed the same
- General management responsibilities have *decreased*

Current Distribution of CE Certification Questions

I.	Technology Management	35%
II.	Service Delivery Management	20%
III.	Product Development, Testing, Evaluation, & Modification	5%
IV.	IT / Telecom	10%
V.	Education of Others	5%
VI.	Facilities Management	5%
VII.	Risk Management / Safety	10%
VIII.	General Management	10%

Published in the CCE Handbook on the ACCE website

Support for the CCE Process – STUDY GUIDE


ACCE Clinical Engineering Certification Study Guide ™

ACCE
AMERICAN COLLEGE OF CLINICAL ENGINEERING

Clinical Engineering Certification Study Guide ©

Version 9.0
May 2020

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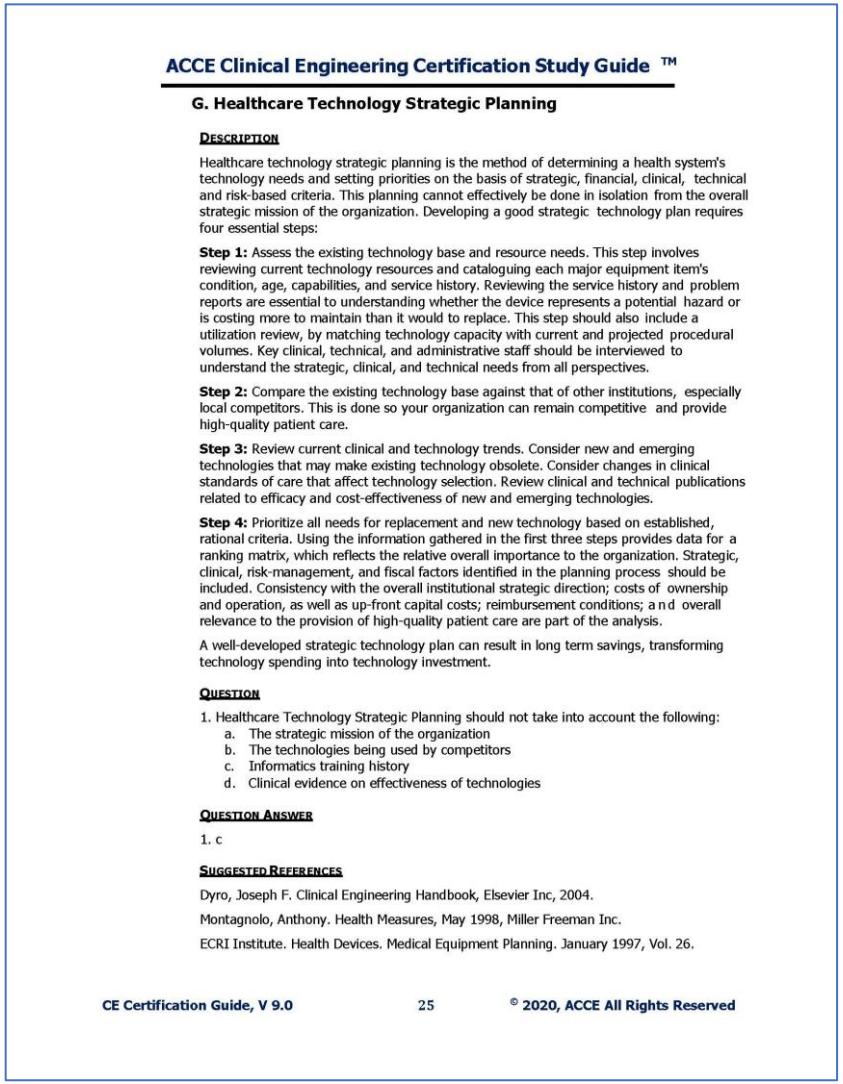
ACCE Clinical Engineering Certification Study Guide ™

G. Healthcare Technology Strategic Planning

DESCRIPTION

Healthcare technology strategic planning is the method of determining a health system's technology needs and setting priorities on the basis of strategic, financial, clinical, technical and risk-based criteria. This planning cannot effectively be done in isolation from the overall strategic mission of the organization. Developing a good strategic technology plan requires four essential steps:

Step 1: Assess the existing technology base and resource needs. This step involves reviewing current technology resources and cataloguing each major equipment item's condition, age, capabilities, and service history. Reviewing the service history and problem reports are essential to understanding whether the device represents a potential hazard or is costing more to maintain than it would to replace. This step should also include a utilization review, by matching technology capacity with current and projected procedural volumes. Key clinical, technical, and administrative staff should be interviewed to understand the strategic, clinical, and technical needs from all perspectives.

Step 2: Compare the existing technology base against that of other institutions, especially local competitors. This is done so your organization can remain competitive and provide high-quality patient care.

Step 3: Review current clinical and technology trends. Consider new and emerging technologies that may make existing technology obsolete. Consider changes in clinical standards of care that affect technology selection. Review clinical and technical publications related to efficacy and cost-effectiveness of new and emerging technologies.

Step 4: Prioritize all needs for replacement and new technology based on established, rational criteria. Using the information gathered in the first three steps provides data for a ranking matrix, which reflects the relative overall importance to the organization. Strategic, clinical, risk-management, and fiscal factors identified in the planning process should be included. Consistency with the overall institutional strategic direction; costs of ownership and operation, as well as up-front capital costs; reimbursement conditions; and overall relevance to the provision of high-quality patient care are part of the analysis.

A well-developed strategic technology plan can result in long term savings, transforming technology spending into technology investment.

QUESTION

1. Healthcare Technology Strategic Planning should not take into account the following:
   a. The strategic mission of the organization
   b. The technologies being used by competitors
   c. Informatics training history
   d. Clinical evidence on effectiveness of technologies

QUESTION ANSWER

1. c

SUGGESTED REFERENCES

Dyro, Joseph F. Clinical Engineering Handbook, Elsevier Inc, 2004.

Montagnolo, Anthony. Health Measures, May 1998, Miller Freeman Inc.

ECRI Institute. Health Devices. Medical Equipment Planning. January 1997, Vol. 26.

98 topics
in 8 sections

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References

- CCE Handbook-2021
  https://accenet.org/CECertification/Documents/2021_CCE_Handbook_FINAL.pdf
- 2018 Body of Knowledge Survey (p.3)
  https://accenet.org/publications/Newsletters/ACCE%20News%20JanFeb2019.pdf
- 2015 Body of Knowledge Survey (p.15)
  https://accenet.org/publications/Newsletters/ACCE%20News%20MayJun%20%202016.pdf
- 2010 Body of Knowledge Survey (p.6)
  https://accenet.org/publications/Newsletters/ACCENewsSummer2011.pdf

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Thank You

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The worldwide BoP & BoK survey

Saide Jorge Calil – GCEA – CED/IFMBE

A bit of history

- In 2004 Dr. Joaquin Nagel (and colleagues) presented the results of a worldwide survey in the Healthcare area, showing that the main problems were lack of highly qualified personnel, limited funding for technical training and continuous pressure to reduce costs by increasing department efficiency.

- In 2005 a meeting co-sponsored by the University of Stuttgart,– IFMBE and ACCE, produced several documents, which included an “Agreement for Mutual Recognition of Qualifications for Clinical Engineers and “Protocol for the Training of Clinical Engineers in Europe”.

- Despite the great effort and excellent result, several obstacles restrained the progress of this initiative to become global

A bit of history

- In 2007, the Clinical Engineering Division of the International Federation for Medical and Biological Engineering - IFMBE CED - developed a survey to understand the ACTIVITIES being developed by Clinical Engineers within their region or country – BoK

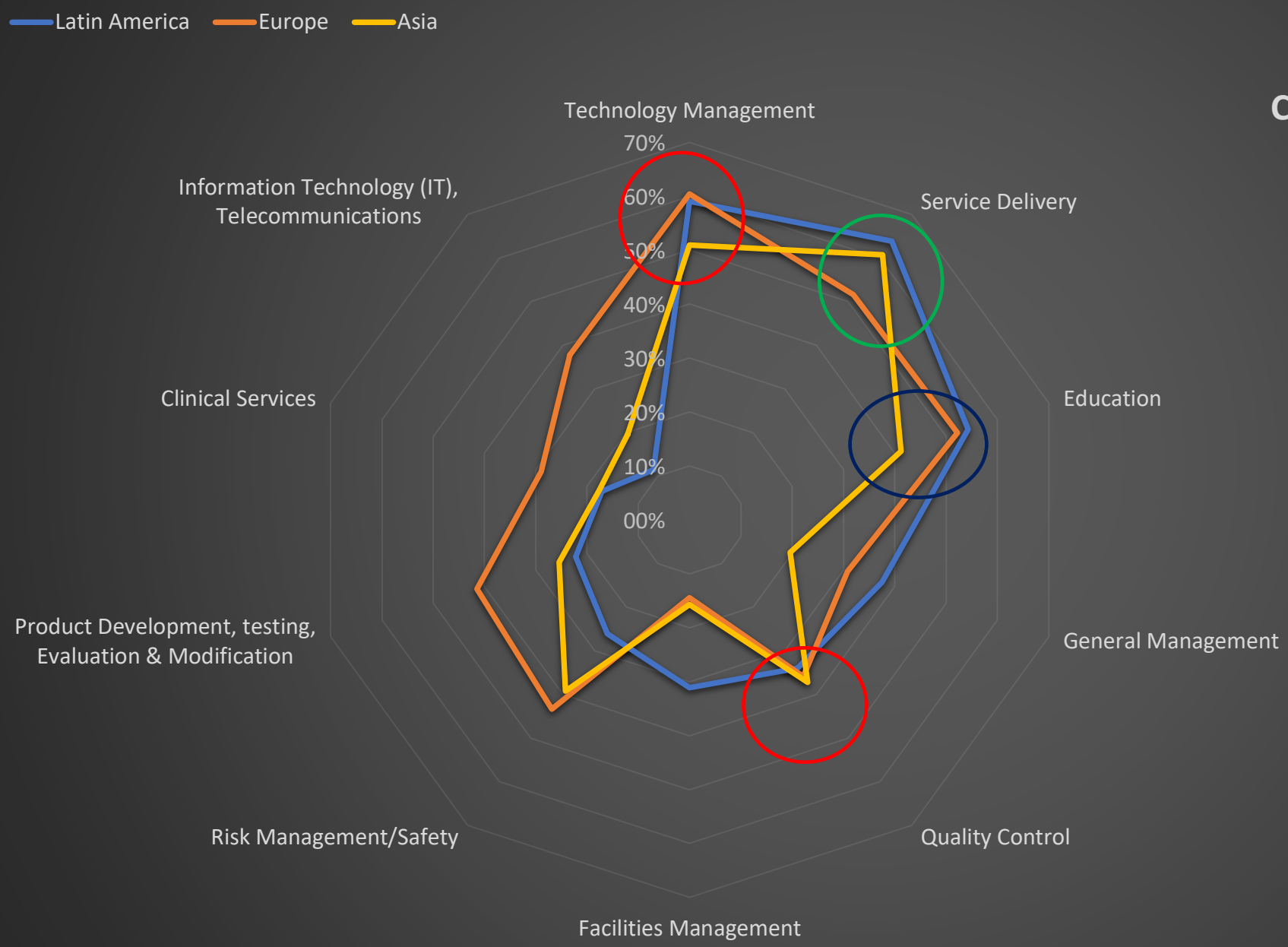
- Objective: Identify the profile of the professional called clinical engineer, its activities and the kind of employer worldwide

Conclusion from 2007

- There are quite similar activities in different parts of the world which are more or less sofisticated according to the culture and knowledge of the country or region.

- These similarities can be the basis for developing stronger international cooperation among clinical engineers and clinical engineering professional organizations

CE Activities involved - 2005



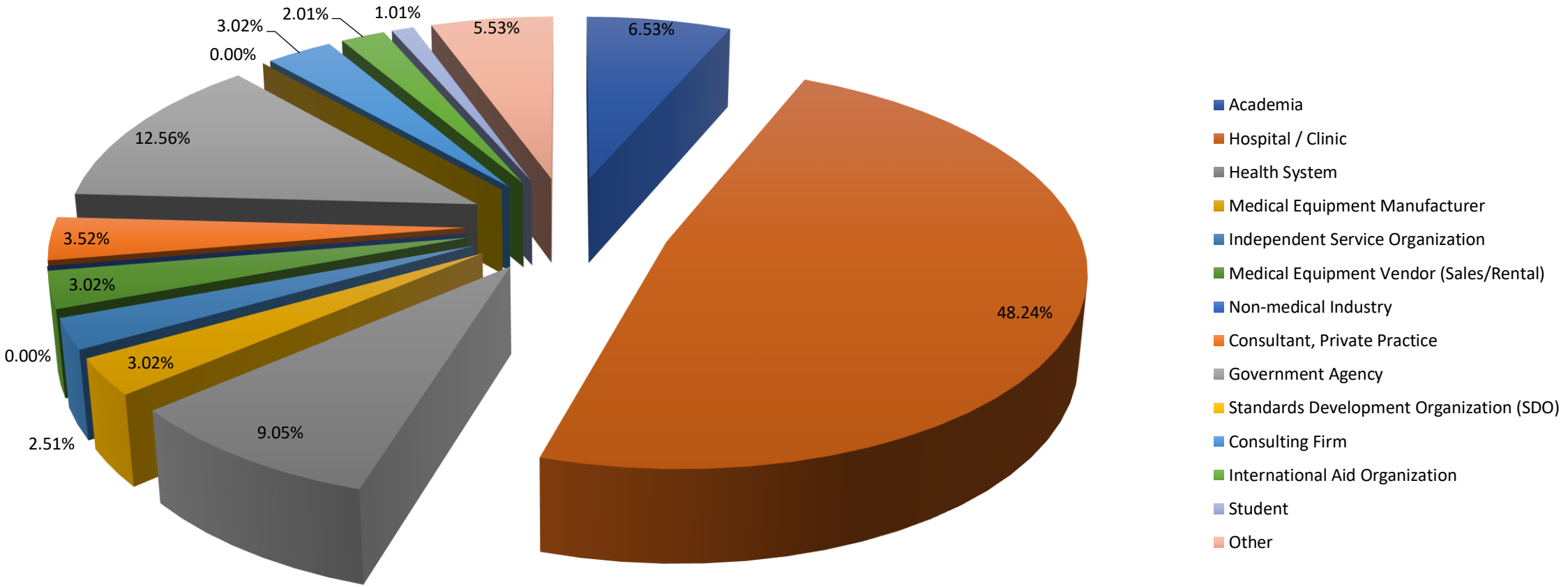
1970 - 1980	1990 – 2015
• Medical Equipment management • Safety • Procurement • Education • Individual product management • Individual thinking	• Medical Equipment Management → Technology management • Safety → Risk Management • Procurement • Education • Disaster preparedness • Cost control (TCO. LCC) • Technology assessment • Tele-medicine (Homecare) • Project Management • Contract Management • Mobile Healthcare (events. transports. group assistance) • Home care • Quality Management • Information Technology (Interoperability) • Human Factor Engineering • Forensic analysis • Artificial Intelligence • Systems integration and management • Soft skills (writing. communication. supervision) • Team practicing

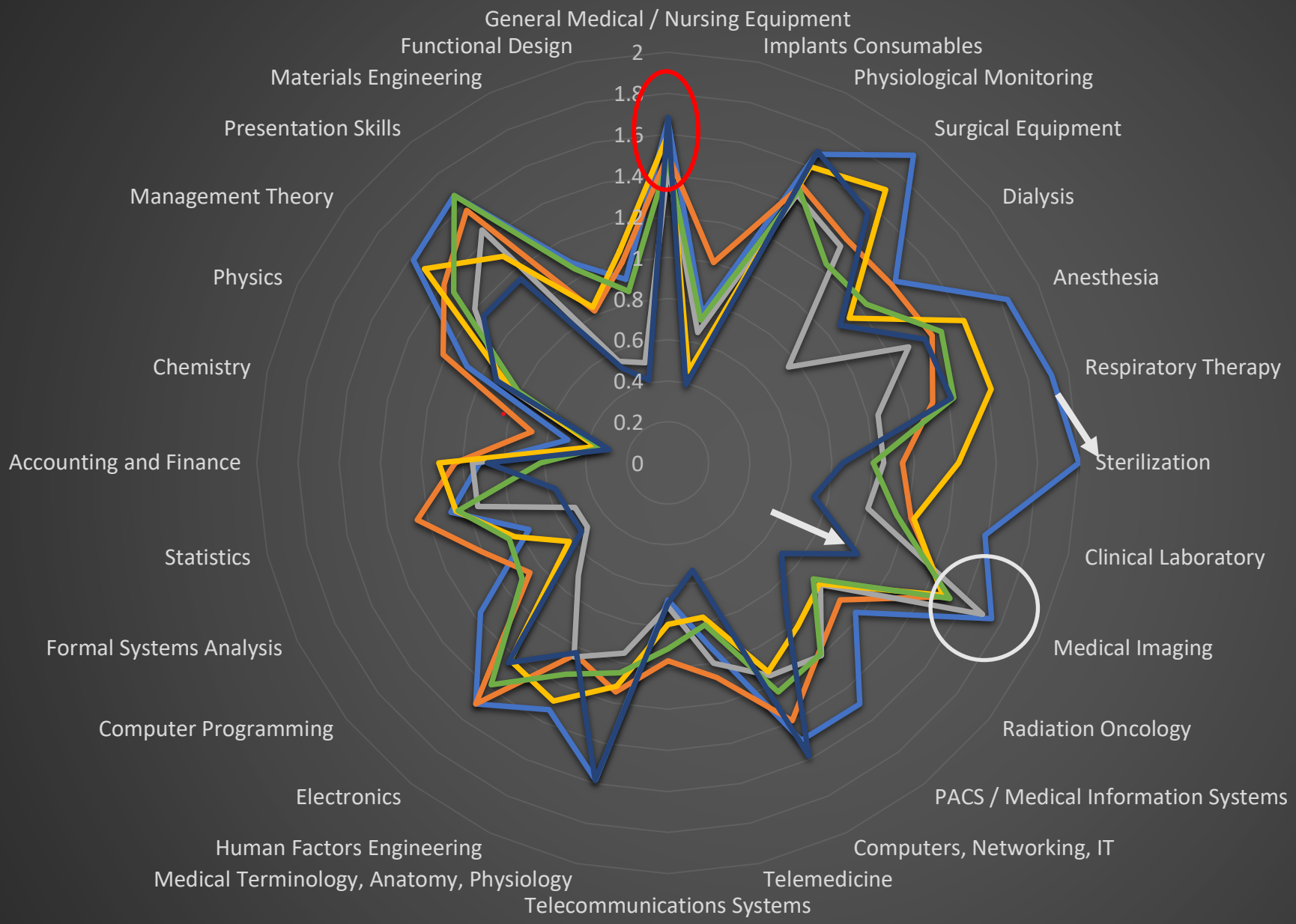
The 2017 survey

- Ten years later, and with enough manpower to work in this project, the Global Clinical Engineering Task Force and IFMBE/CED developed a second survey that not only update the CE activities (Body of Practice) but also help to set this academic curriculum called Body of Knowledge (BOK). – Survey structure based on the ACCE model

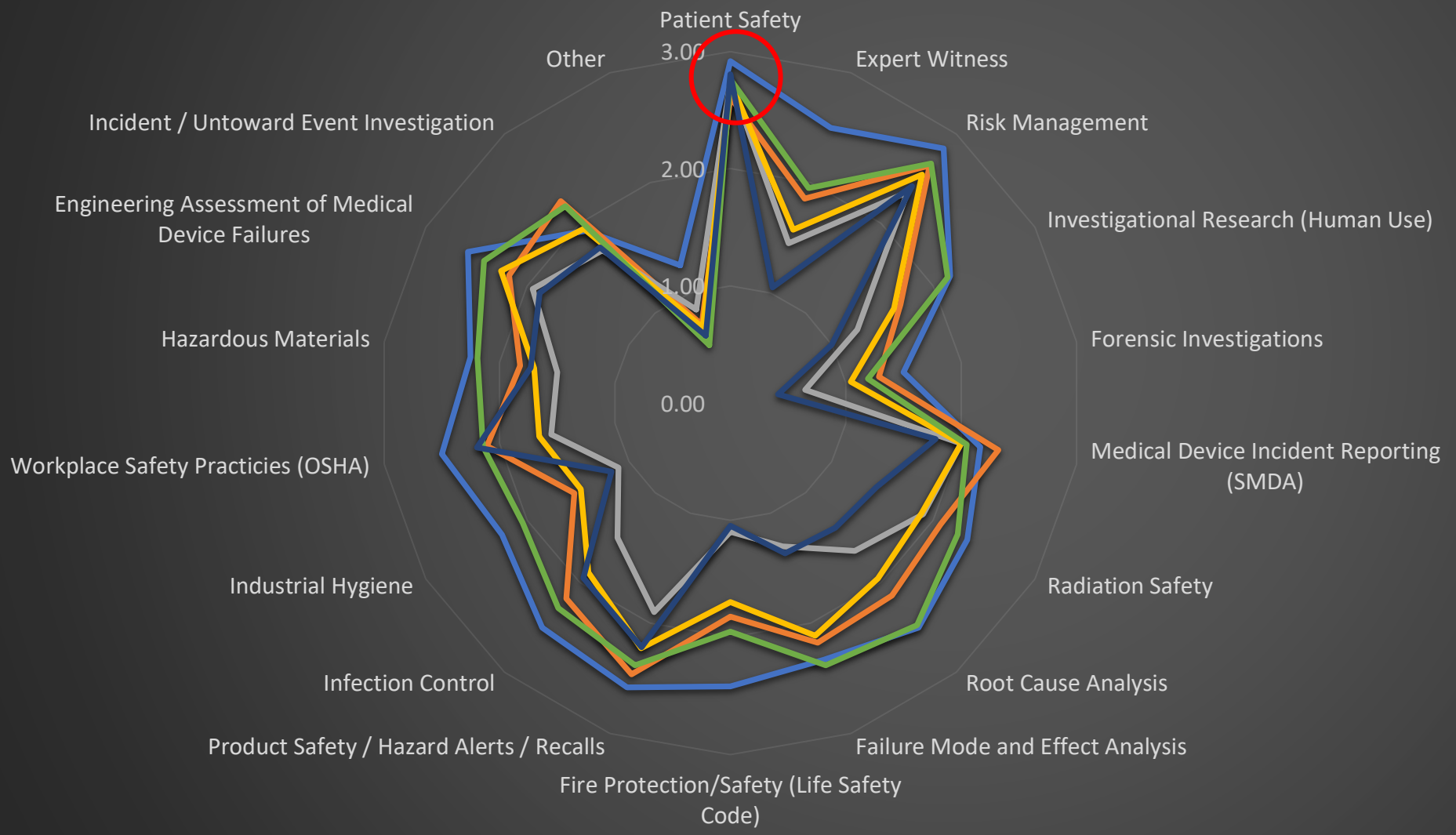
- This survey was divided into five sections, aiming at collecting different pertinent types of information:
  - Contact Information
  - Job Information
  - Knowledge
  - Responsibilities
  - Work Activities

Current Employer





Level of importance of Background **Knowledge** for CEs to develop their daily work activities.
Minor =0
Moderate = 1
High importance = 2



Risk Management/ Safety Responsibilities

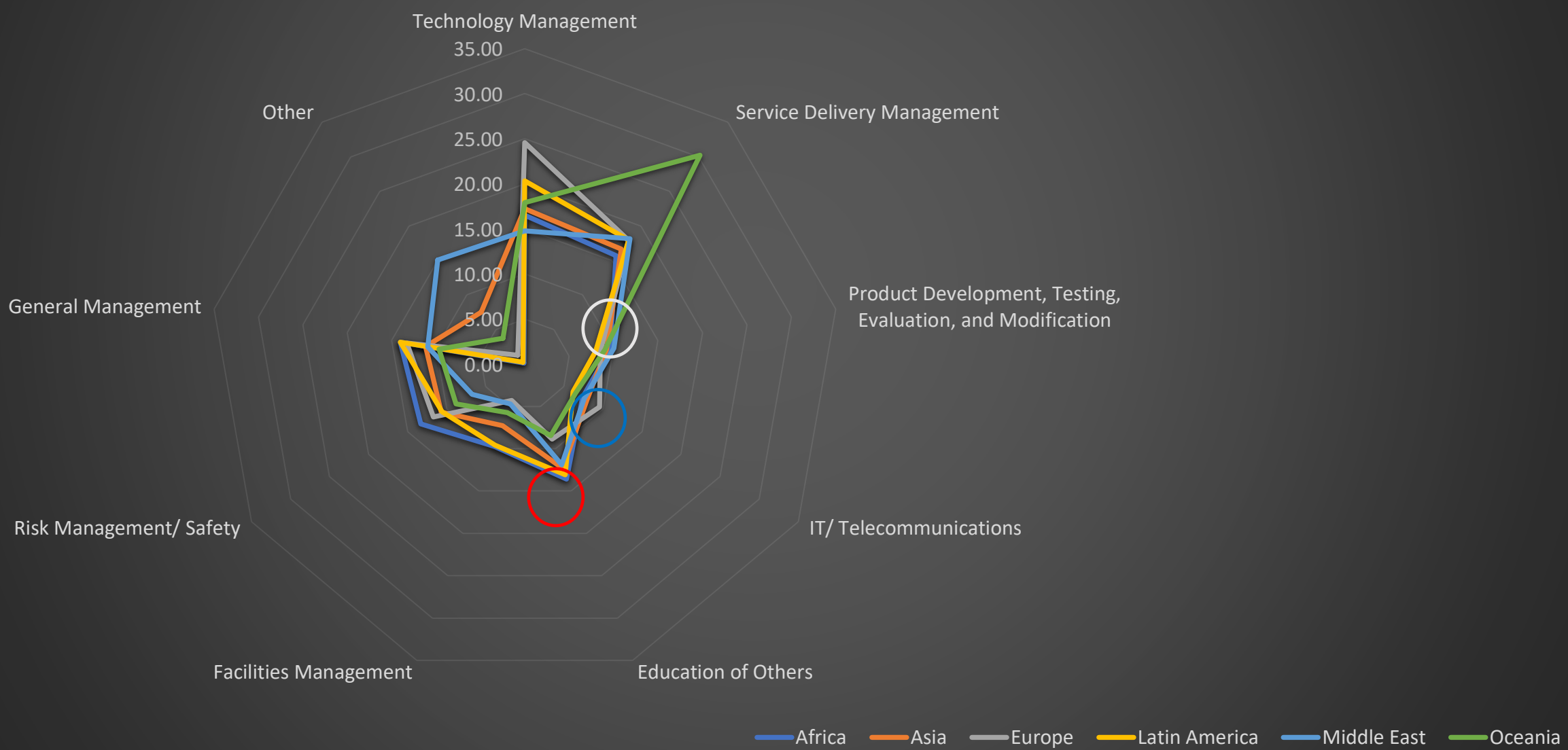
No = 0

Minor = 1

Moderate =2

High importance = 3

Work Activities [% of time]



Discussion

- One of the most challenging tasks when designing a worldwide data collection tool in the form of a survey is to develop a question that has the exact meaning to all respondents.

- Due to language and culture differences as well as different academic systems and job titles, people tend to respond according to the regional characteristics, which cause some distortions in the analysis of the results.

- Some of the data obtained can be corrected by a simple translation to English while others would be necessary to have a deeper understanding of the country's academic system.

Discussion

- There is a need to periodically update the information obtained in this survey since the Clinical Engineering profession is extremely dynamic.
- For almost every new technology and procedure to be used in the healthcare area, a new set of knowledge is required regarding technology life cycle stages from innovation all the way to disposal and replacement.
- It was possible to see that despite the difference between countries concerning CE practices, there is a common set of body of practices and consequently Body of needed knowledge worldwide
- However, more studies are necessary to define a solid worldwide Body of Knowledge and Body of Practice for the Profession.

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Thank you!

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The Clinical Engineering profession

Stefano Bergamasco, Italian Clinical Engineers Association
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An interesting perspective on Clinical Engineering activities

Global Clinical Engineering Journal

Is Clinical Engineering an occupation or profession?

By Y. David[1], S. Calil[2], N. Pallikarakis[3], M. Poluta[4], S.Bergamasco[5], D. Clark[6], T. Judd[7], J. Wear[8], K. Fukuta[9], S. Mullaly[10], W. Morse[11]

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[11] Founding member of ACCE and President in Bellegrove Medical, USA

www.globalce.org

Definitions - Occupation

When humans spend time trying to achieve something, especially when this involves using some effort, it is called **work**. There are many different types of work. **Occupation** is one of many types of work which one occupies oneself with; **usually refers to productive activity, task, service, trade, or craft for which one is paid**

An Occupation is a work activity undertaken by a person to earn a living. It can be:

- Business
- Profession
- Employment

Occupation refers to the kind of economic activity endeavored by a person regularly for earning money.

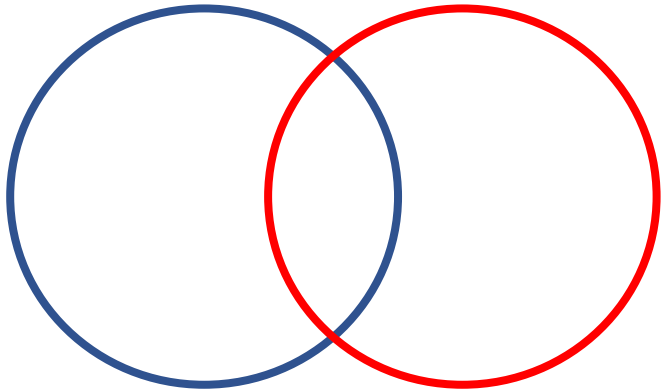
Definitions - Profession

Profession is an activity that requires specialized training, knowledge, qualification, and skills. It implies membership in a professional body, credentialing, and certificate of practice. The individuals who undertake a profession of rendering personalized services are called professionals, guided by a specific professional body code of conduct.

The main objective of the profession is to render services to those who need them.

A professional body or statute governs the profession. To be called a professional, a person has to pursue higher studies and qualify for an exam conducted by the governing body. In addition, the professional body develops ethical codes that the professionals must follow to ensure uniformity in their work.

A clear demarcation?



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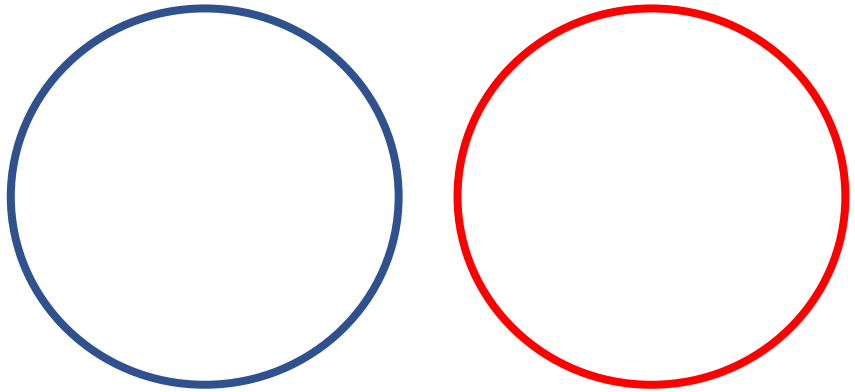

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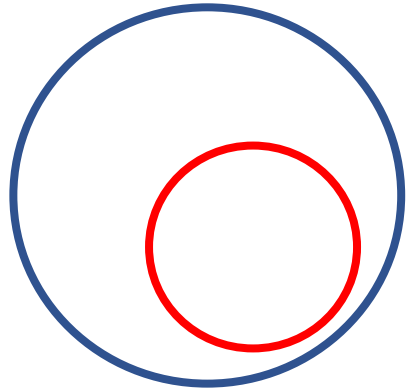

3

A profession is an occupation for which a person undergoes specialized training or internship to get a higher degree of education and expertise in the concerned area.

Should be “3”? … let’s dig further …

Main differences (open for discussion …)

1. Unlike an occupation, a profession has an expected **code of conduct**.

2. An occupation does not require lengthy training in a particular field, but a profession requires **specialized training in a specific area**.

3. In general, the practice in a profession is **regulated by a particular or professional body** statute while an occupation is not.

4. A person with an occupation is paid for what he produces. Whereas in a profession, one gets **paid according to his knowledge and expertise**.

5. The profession is also an occupation when the person is paid for **utilizing his skills and expertise**.

6. A professional is **independent**, and any external force does not influence their work. However, conversely, there is a lack of independence in an occupation because the person performing it has to follow the commands of his supervisors.

7. Some **conduct responsibilities** are associated with the practice of a profession. However, an occupation does not have such responsibilities.

8. The **basic pay** in a profession usually is higher than in an occupation.

9. Professionals are usually respected more by people and have a higher **status in society** than those in an occupation.

Examples of professions

Medical doctor

Nurse*

Lawyer

Architect

* Good example of progress towards professionalism

....

How about engineers?

And clinical engineers?

Engineering and engineers

Engineering is defined as the "*application of science and mathematics to solve problems useful to people.*"

The **practice of engineering** is defined as "*any service or creative work requiring engineering education, training, and experience in the application of engineering principles and the interpretation of engineering data to engineering activities that potentially impact the health, safety, and welfare of the public.*"

An **engineer** is defined as "*an individual who is qualified to practice engineering by reason of* ***engineering education, training, and experience*** *in the application of engineering principles and the interpretation of engineering data.*"

And **Professional Engineer** means "*an individual who has been* ***duly licensed*** *as a professional engineer by the board. The board may designate a professional engineer, on the basis of* ***education, experience, and examination****, as being licensed in a specific discipline or branch of engineering signifying the area in which the engineer has demonstrated competence.*"

[National Society of Professional Engineers]

Engineering and engineers

Like medicine, in engineering, public health, safety, and welfare tasks are expected to be protected from unintended consequences.

Engineering is clearly a Profession. Some relevant characteristics:

- Mastery of their domain of practice
- Remain current with the growth and changes in that knowledge base
- Need to make complex judgments and decisions leading to skilled actions, sometimes under uncertain conditions
  - *engineers must be appropriately trained to operate at the uncertain limits of their previous experience*
  - *learn from the consequences of their actions to develop new understandings and better routines*
  - *exchanging those understandings with other professionals so the entire professional community benefits from their insight*

Clinical Engineering practice

Perhaps faster than in the other professions we discussed earlier, the knowledge that a clinical engineer draws from is continually expanding and evolving because of the technological evolution and clinical practice itself.

Common characteristics of a professional clinical engineer:

- **commitment to serve** in the interests of specific clients and the general welfare of humankind
- a **body of knowledge** and principles
- specialized set of **skills, practices, and performances**
- capacity to render judgments **ethically and with integrity**
- commitment to engage in **continuing education** and learning attitude to absorb new knowledge from the contexts of practice
- development of a **professional community** responsible for the oversight and monitoring of quality in both practice and professional education

Clinical Engineering practice

Basis for Comparison	Occupation	Profession	Clinical Engineering
Meaning	Occupation refers to the regular activity performed by a person to earn a living	A profession is an occupation or vocation which requires academic preparation for knowledge and expertise in the specific field	Requires a degree of knowledge and expertise in the specific field
Code of Conduct	No	Yes	Partial
Training	Not necessary	Compulsory	Necessary
Regulated by Statute	No	Mostly yes	Country Dependent
Basis of pay	Produce	Skill and Knowledge	Skill and Knowledge
Higher Education	Not compulsory	Yes	Not compulsory
Degree of Independence	Usually there is no independence	A profession is completely independent	Some degree of independence
Responsibilities	Very limited	Yes	Yes
Respect and status	Low	Very high	Partially

Where do you work as a clinical engineer?

Hospital (public or private)

Independent Service Organization

Manufacturer

Freelance

University

Consulting company

Do you live your role as an Occupation or as a Profession?

Hint: The answer does not depend on being employed rather than a freelance or an entrepreneur!

What do we need to improve towards professionalism?

Critical differentiators between an occupation and a profession, in our case of clinical engineers, are having attributes such as:

1. a **Body of Knowledge** with high degree of systematic continuous training,
2. mastery of their domain,
3. commitment to selflessly and ethically serve,
4. ability to render professional judgement,
5. self-governance by monitoring the quality-of-service members provide through a **credentialing program**

Clinical Engineering **certification and/or professional engineering registration** are required

-> It may now be better to initiate a ***new internationally coordinated effort*** to achieve broad adoption of this crucial professional trait)

What do we need to improve towards professionalism?

Clinical engineering as a professional field will gain recognition through:

- a better definition of minimum academic preparation requirements
- increase compliance with a public declaration of practice proficiency (certification)
- commitment to continuing education
- adoption of expected ethical behavior

We will gain further recognition when an **international uniformity** is adopted

We recommend that the **Global Clinical Engineering Alliance** will best serve as a leader for collaboration between stakeholders such as academia, industry, healthcare providers, and government agencies.

A key takeaway message …

Working together to facilitate what clinical engineering practitioners deserve - be the engineering and technology professionals within the healthcare team.

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Thank you!

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Q&A

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What are the Clinical Engineering activities worldwide (BoP), and the needed knowledge (BoK), to perform them

The road ahead...?

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A list of additional topics and dates for next webinars will be soon published on our website www.GlobalCEA.org

THANK YOU
for your participation