TLP:GREEN

DEVELOPING A SECTORAL CERT ECOSYSTEM

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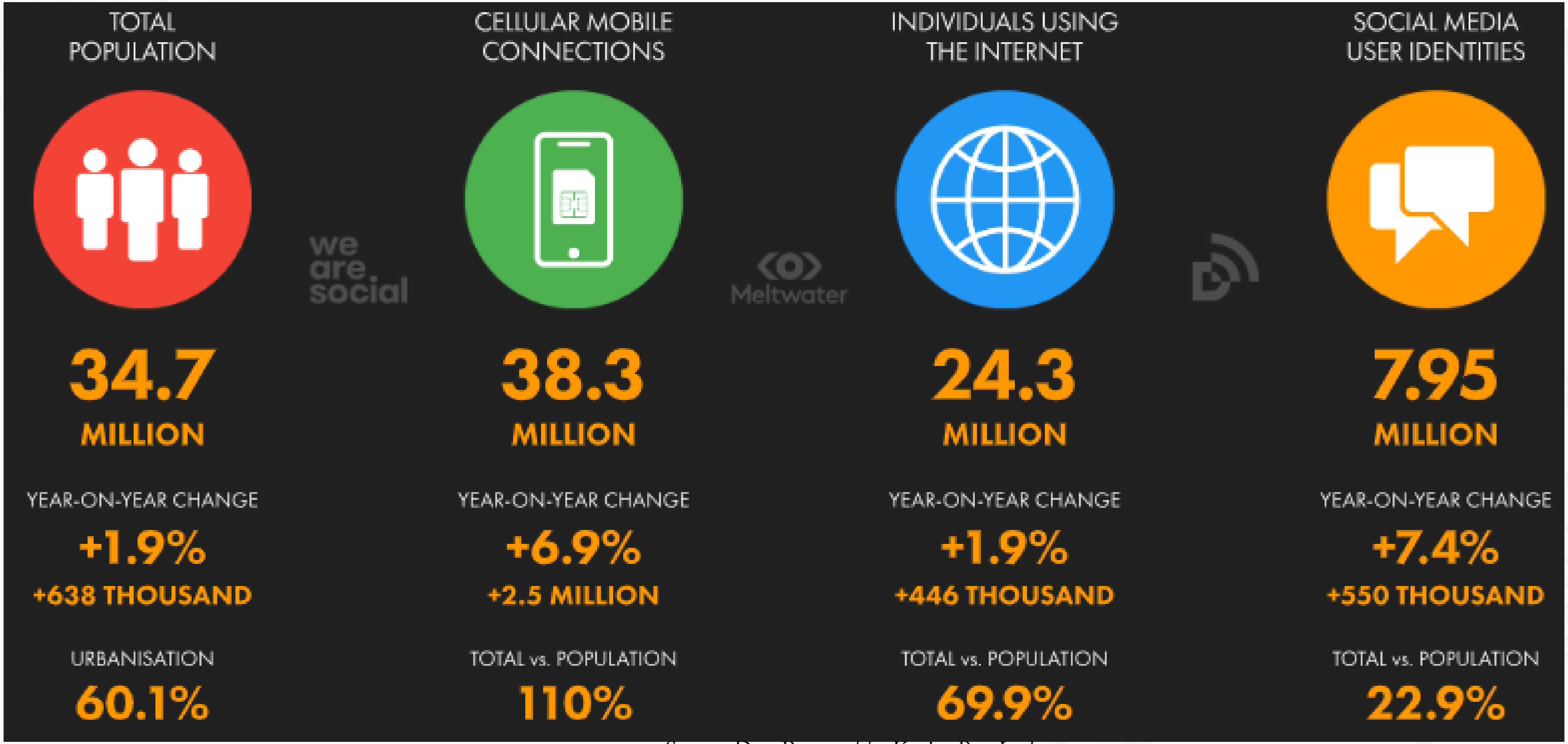
Bio

- ~20 years in ICT (most of it in the Telecommunications sector)
- Ag. Deputy Director-General (Technical Operations) – National CERT, CII Protection, Law Enforcement Liaison, Cybersecurity Standards Development
- Longtime International Information System Security Certification Consortium (ISC2) volunteer

Presentation Outline

- Country Profile
- Introduction – CERT Ecosystem Models
- Building Blocks for an Effective Ecosystem
- Ecosystem Architecture
- The Ecosystem in Action
- Key Lessons
- Development Roadmap
- Conclusion

Country Profile – A fast-growing Digital Ecosystem


we are social
Meltwater

TOTAL POPULATION	CELLULAR MOBILE CONNECTIONS	INDIVIDUALS USING THE INTERNET	SOCIAL MEDIA USER IDENTITIES
34.7 MILLION	38.3 MILLION	24.3 MILLION	7.95 MILLION
YEAR-ON-YEAR CHANGE	YEAR-ON-YEAR CHANGE	YEAR-ON-YEAR CHANGE	YEAR-ON-YEAR CHANGE
+1.9%	+6.9%	+1.9%	+7.4%
+638 THOUSAND	+2.5 MILLION	+446 THOUSAND	+550 THOUSAND
URBANISATION	TOTAL vs. POPULATION	TOTAL vs. POPULATION	TOTAL vs. POPULATION
60.1%	110%	69.9%	22.9%

Source: DataReportal by Kepios Pte. Ltd

Country Profile – Ghana’s Cybersecurity Journey

2017:

- Cyber Security Secretariat established
- National Cyber Security Technical Working Group constituted
- National Cyber Security Inter-Ministerial Advisory Council formed

2018:

- National Cyber Security Centre established
- Oxford Cybersecurity Capacity Maturity Model administered

2020:

- Cybersecurity Act passed

2021:

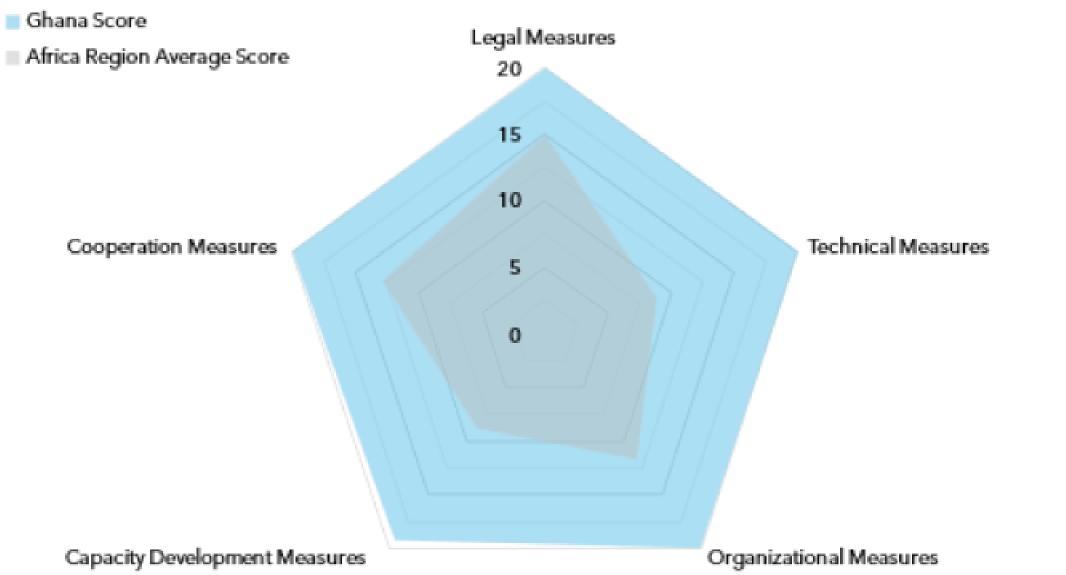
- Cyber Security Authority (CSA) established
- Directive for the Protection of CII released

2024:

- Revised National Cybersecurity Policy & Strategy launched
- Revised Child Online Protection Framework established

Source: DataReportal by Kepios Pte. Ltd

Country Profile – ITU Global Cyber Index Progression



Country Score
out of maximum 20 points per pillar

Legal Measures	Technical Measures	Organization Measures	Capacity Development	Cooperation Measures
20	20	20	19.27	20

Areas of Relative Strength

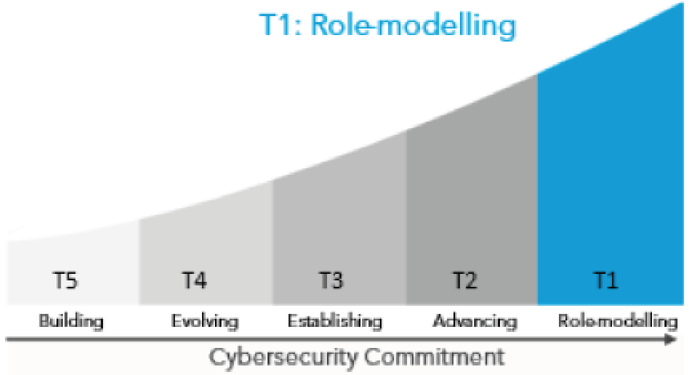
Legal Measures
Technical Measures
Organization Measures
Cooperation Measures

Area of Potential Growth

Capacity Development Measures

Tier Performance

T1: Role-modelling

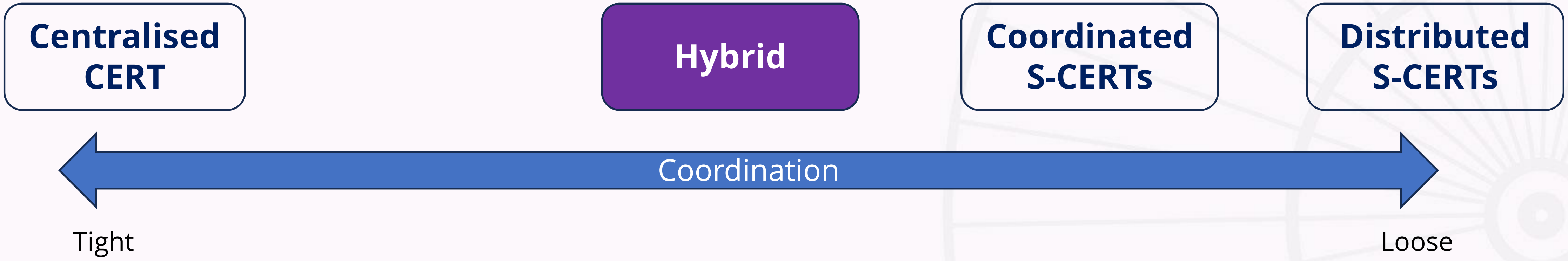


YEAR	SCORE
2017	32.60%
2020	86.69%
2024	99.27%

Source: DataReportal by Kepios Pte. Ltd

Introduction – CERT Ecosystem Models

There are multiple ways to build a CERT ecosystem depending on factors such as the **country’s size**, **available resources**, **existing cybersecurity infrastructure**, **specific threat landscape** and ultimately **government policy**.



Centralised CERT

Hybrid

Coordinated S-CERTs

Distributed S-CERTs

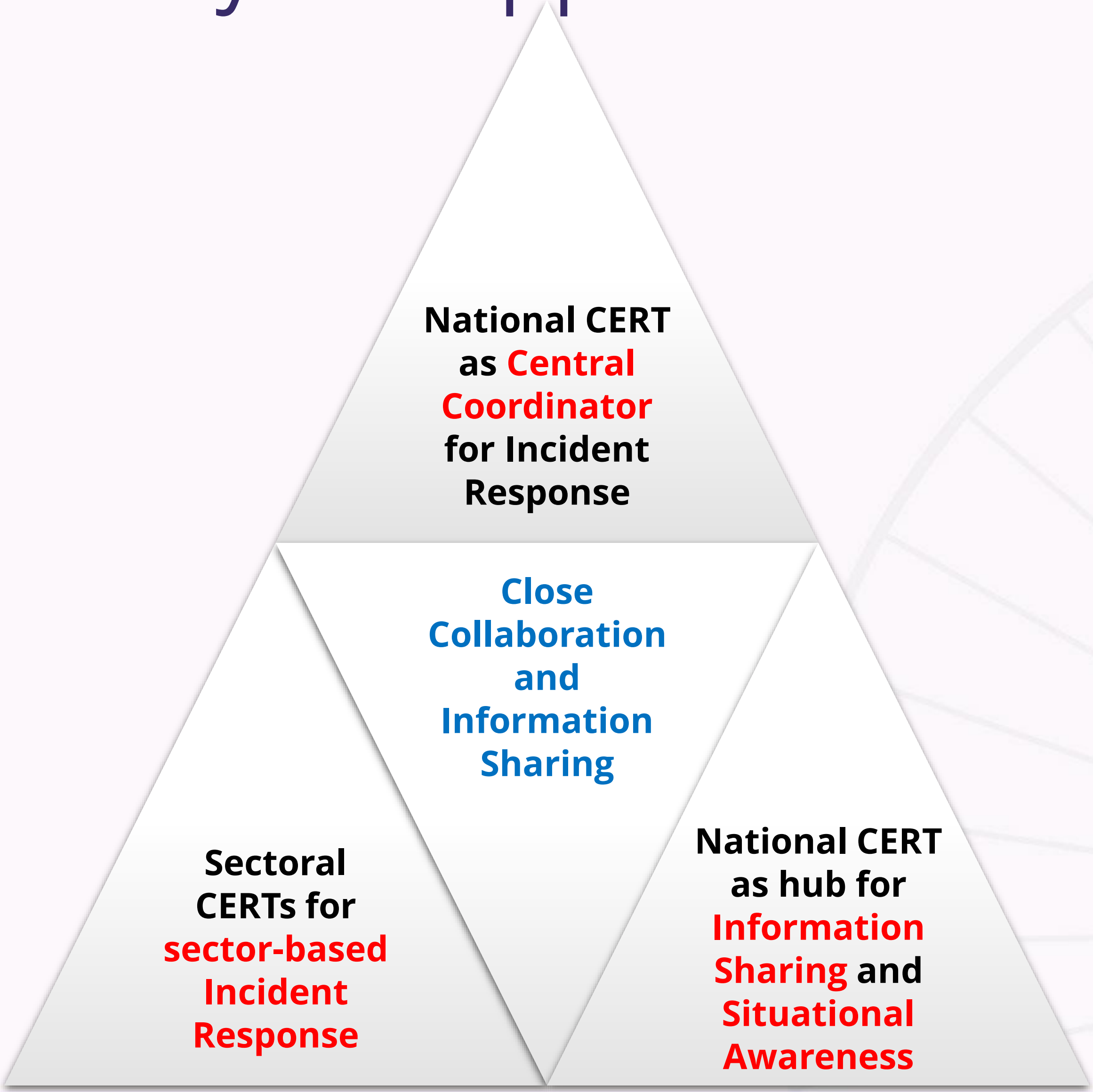
Coordination

Tight

Loose

Source: DataReportal by Kepios Pte. Ltd

Introduction – A Hybrid Approach



National CERT as Central Coordinator for Incident Response

Close Collaboration and Information Sharing

Sectoral CERTs for sector-based Incident Response

National CERT as hub for Information Sharing and Situational Awareness

Source: DataReportal by Kepios Pte. Ltd

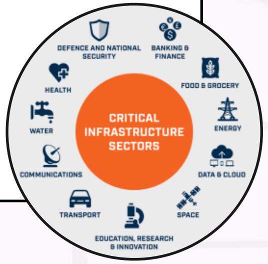
Building Blocks for an Effective Ecosystem

- Leverage sector skillset to complement efforts of National CERT.
- Leverage capacity of sector regulators.

Strategic Philosophy: “Cybersecurity is a team sport”

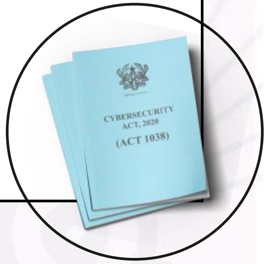
- Identification, designation and regulation of critical sectors.
- Some sectors are prioritised to have a CERT.

Critical Information Infrastructure Protection


CRITICAL INFRASTRUCTURE SECTORS
DEFENCE AND NATIONAL SECURITY
BANKING & FINANCE
FOOD & GROCERY
ENERGY
DATA & CLOUD
SPACE
EDUCATION, RESEARCH & INNOVATION
TRANSPORT
COMMUNICATIONS
WATER
HEALTH

- Clearly-defined mandates
- Authority to carry out functions, especially oversight.

Designated Coordinating Agency backed by Law



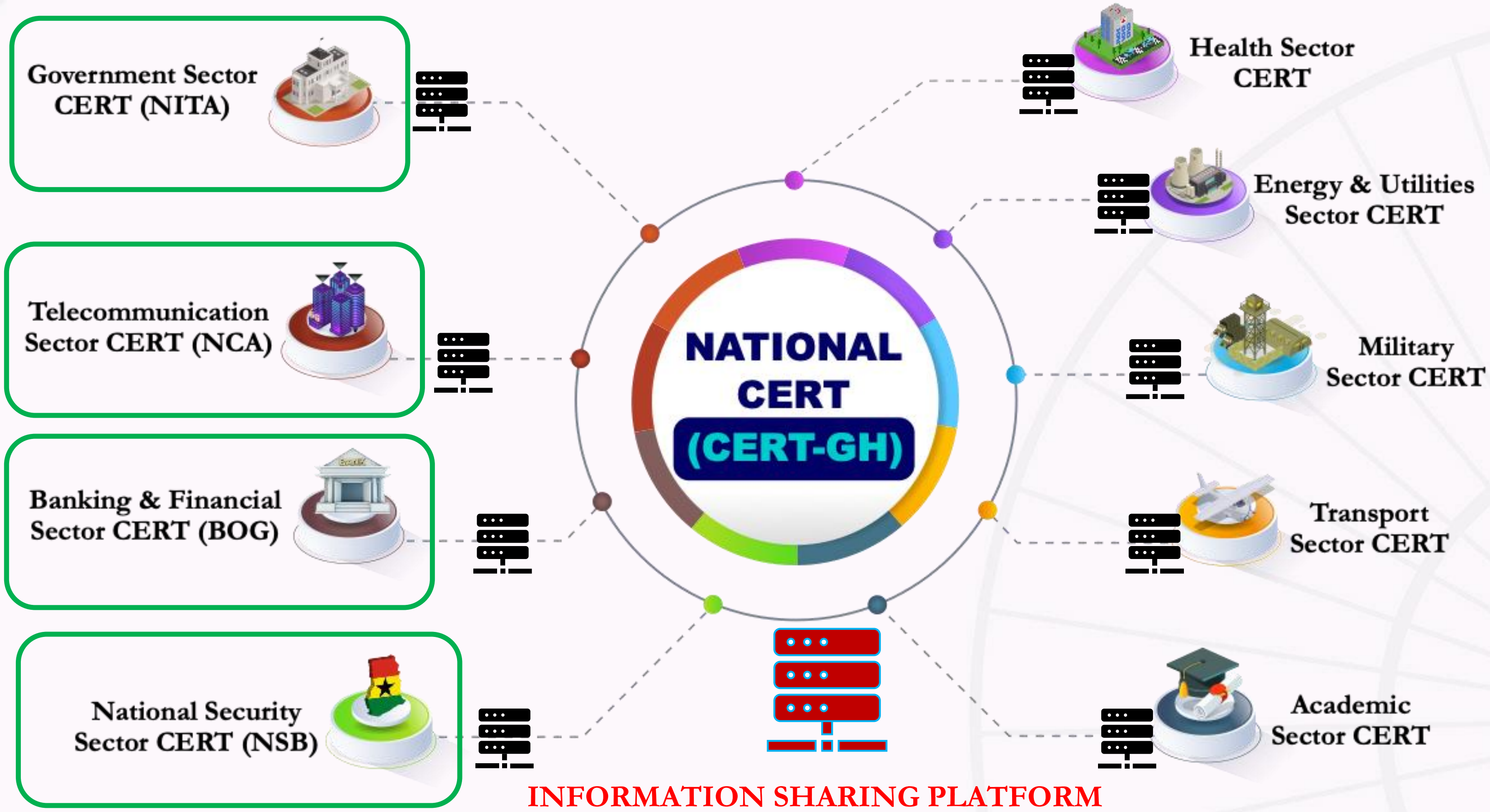
Source: DataReportal by Kepios Pte. Ltd

Ecosystem Architecture – Link to CII Protection

- National Security & Intelligence 01
- ICT 02
- Banking & Finance 03
- Energy 04
- Water 05
- Transportation 06
- Health 07
- Emergency Services 08
- Government 09
- Food & Agriculture 10
- Manufacturing 11
- Mining 12
- Education 13

Source: DataReportal by Kepios Pte. Ltd

CERT Ecosystem Architecture


Government Sector CERT (NITA)
Telecommunication Sector CERT (NCA)
Banking & Financial Sector CERT (BOG)
National Security Sector CERT (NSB)
NATIONAL CERT (CERT-GH)
Health Sector CERT
Energy & Utilities Sector CERT
Military Sector CERT
Transport Sector CERT
Academic Sector CERT
INFORMATION SHARING PLATFORM

Source: DataReportal by Kepios Pte. Ltd

Roles & Responsibilities within the Ecosystem

Cyber Security Authority	Establish Sectoral CERTs	Accredit Sectoral CERT operations	Establish an incident monitoring and response system	Give regulatory directives
	Establish an early warning system	Interception capability	Disable or takedown malicious services	
National CERT	Collect and collate all cybersecurity incidents	Co-ordinate incident responses	Oversee Sectoral CERT operations	International Cooperation
Sectoral CERT	Collect and collate cybersecurity incidents	Co-ordinate incident responses within the sector	Establishment and operational cost	Incident Reporting
	Adhere to risk management protocols	Comply with regulatory directives	Generate periodic operations reports	

Source: DataReportal by Kepios Pte. Ltd

The Ecosystem in Action

Feb-2024: Notification by FIRST to CERT-GH of data breach affecting a private institution triggered remediation as well as notice to Bank of Ghana and Data Protection Commission (JCC members).

Aug-2024: Banking & Finance Sector CERT picked up dark web exposure of private ICT sector entity. CERT-GH engages entity for remediation.

Oct-2024: Telecoms Sector CERT picked up data breach impacting Energy Sector entity. CERT-GH & CIIP engage entity for remediation.

Apr-2025: Technology partner flags dark web leakage impacting a member of the Banking and Finance sector. CERT-GH alerted the Financial CERT for remediation.

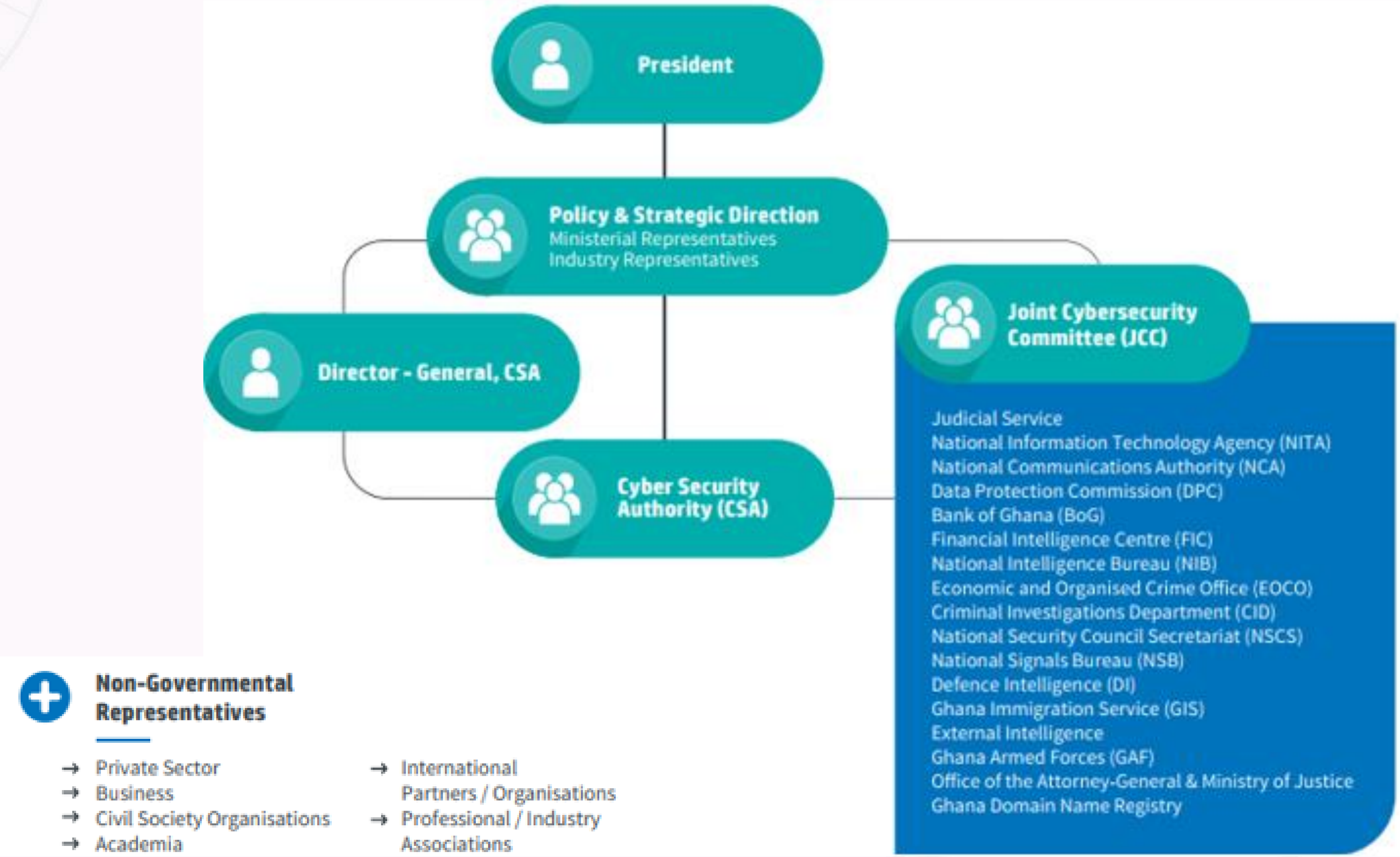
Source: DataReportal by Kepios Pte. Ltd

Key Lessons

- Building trust through **collaborative regulation** works.
- Robust **communication and coordination** mechanisms are essential.
- Sectoral CERTs must be **empowered** to fund their operations to remain sustainable.
- It is crucial to have an **inclusive institutional framework** for cybersecurity leadership.

Source: DataReportal by Kepios Pte. Ltd

Key Lessons - Inclusive Institutional Framework



President

Policy & Strategic Direction
Ministerial Representatives
Industry Representatives

Director - General, CSA

Cyber Security Authority (CSA)

Joint Cybersecurity Committee (JCC)

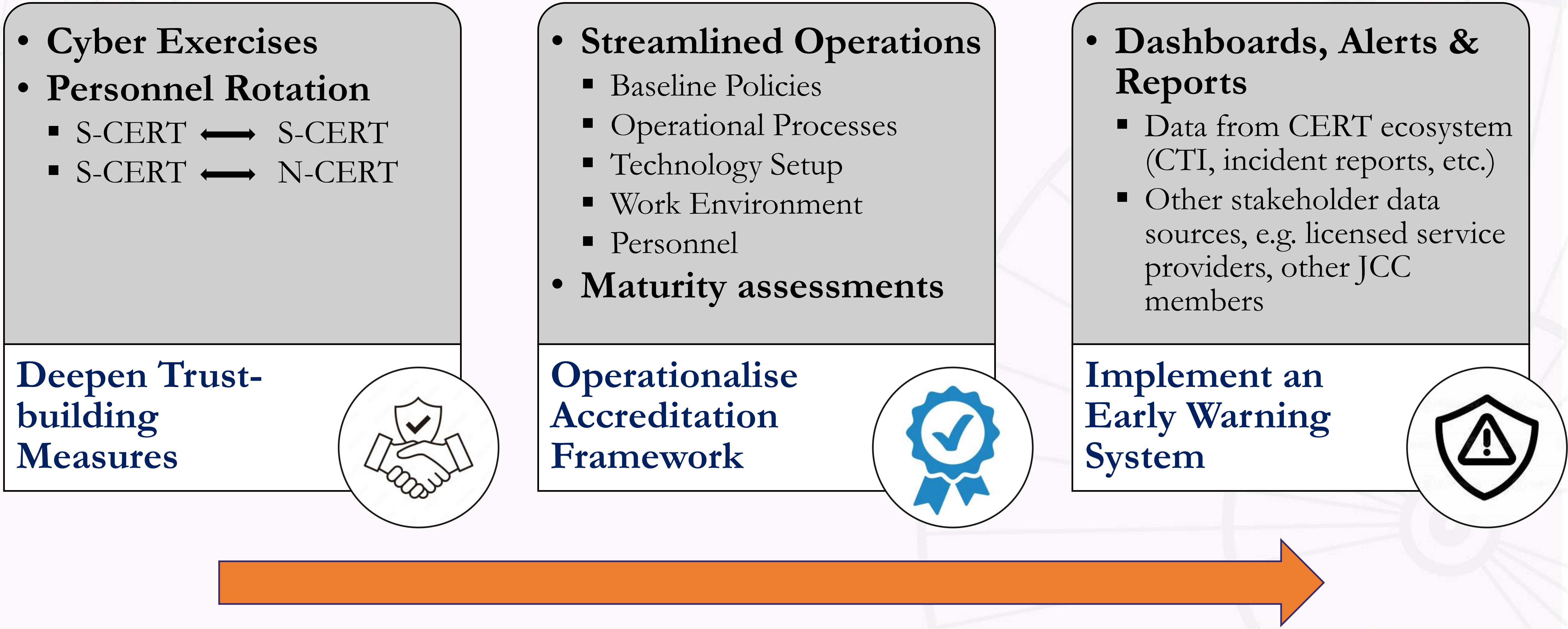
- Judicial Service
- National Information Technology Agency (NITA)
- National Communications Authority (NCA)
- Data Protection Commission (DPC)
- Bank of Ghana (BoG)
- Financial Intelligence Centre (FIC)
- National Intelligence Bureau (NIB)
- Economic and Organised Crime Office (EOCO)
- Criminal Investigations Department (CID)
- National Security Council Secretariat (NSCS)
- National Signals Bureau (NSB)
- Defence Intelligence (DI)
- Ghana Immigration Service (GIS)
- External Intelligence
- Ghana Armed Forces (GAF)
- Office of the Attorney-General & Ministry of Justice
- Ghana Domain Name Registry

Non-Governmental Representatives

→ Private Sector
→ Business
→ Civil Society Organisations
→ Academia
→ International Partners / Organisations
→ Professional / Industry Associations

Source: DataReportal by Kepios Pte. Ltd

Development Roadmap



- **Cyber Exercises**
- **Personnel Rotation**
  - S-CERT ⟷ S-CERT
  - S-CERT ⟷ N-CERT

Deepen Trust-building Measures

- **Streamlined Operations**
  - Baseline Policies
  - Operational Processes
  - Technology Setup
  - Work Environment
  - Personnel
- **Maturity assessments**

Operationalise Accreditation Framework

- **Dashboards, Alerts & Reports**
  - Data from CERT ecosystem (CTI, incident reports, etc.)
  - Other stakeholder data sources, e.g. licensed service providers, other JCC members

Implement an Early Warning System

Source: DataReport by Kepios Pte. Ltd

Conclusion

A well-coordinated Sectoral CERT ecosystem, leveraging synergy among key stakeholders, is pivotal to bolstering national cybersecurity.

Source: DataReportal by Kepios Pte. Ltd

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Source: DataReportal by Kepios Pte. Ltd

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