Communications Regulatory Authority
State of Qatar

هيئة تنظيم الاتصالات
دولة قطر

Information and Communications Technology (ICT) Sector Taxonomy Principles and Categories (ICT Sector Classification)

CRARAC 2023/11/5

TABLE OF CONTENTS

1. Executive Summary

The Information and Communications Technology (ICT) Sector Taxonomy Principles and Categories ("**ICT Classification**") seeks, (i) to establish Qatar's national ICT sector taxonomy principles and categories to help better understand the ICT sector's business maturity in Qatar, (ii) to establish a national framework that supports further development of relevant policies, (iii) to provide guidance for companies in the ICT sector on mapping their ICT products and services against an established sector classification including where on the value chain their business stands, and (iv) to enable all stakeholders to better assess the overall sector and conduct outcome-driven analyses.

The domains considered under the so called "technology umbrella" of the ICT Classification include:

1. Information Technology (IT), inclusive of:
    a. Traditional information technology - refers to the use of any computers, storage, networking and other physical devices, infrastructure, and processes to create, process, store, secure and exchange all forms of electronic data.
    b. Emerging technologies (ET) – refer to innovative technologies that have been recently developed, are underdeveloped, or will be developed within the next few years, and that are creating, or are expected to create, significant social or economic effects.
2. Communications Technology (CT)
    a. Technologies related to offering services which provide access to voice, internet, and data services through telecommunications networks and inclusive of all telecommunications standards.
    b. CT is considered as a separate category due to following reasons: (1) The size and relevance of the telecommunications sector are still significant; (2) Including a telecommunications category is aligned with leading benchmarks; (3) It allows visibility to track the shift of telecommunication-based businesses towards provision of IT products and services; (4) It falls into CRA's mandate to regulate Qatar's telecommunications sector.

Currently, Operating Technologies (OT) are not considered in the ICT Classification. OT refers to technologies which are used in industrial setups and environments. as per the CRA Strategy 2020-2024 ICT sector definition used as a baseline to build this ICT Classification, OT falls outside the scope of this definition. It shall be note that in future review cycles of the Classification, OT may be considered to be potentially added as an additional layer based on market evidence or strategy revision.

The developed ICT Classification has three levels of granularity: Category 1, Category 2, and Category 3. Adjacent to these three categories, a horizontal layer of value chain activities (e.g., R&D, sales) is added to map the business profiles of local market players across all categories.

Throughout the document, “Classification” refers to the total of taxonomy principles and structure, including the classification of ICT activities and the categories across the *value chain*.

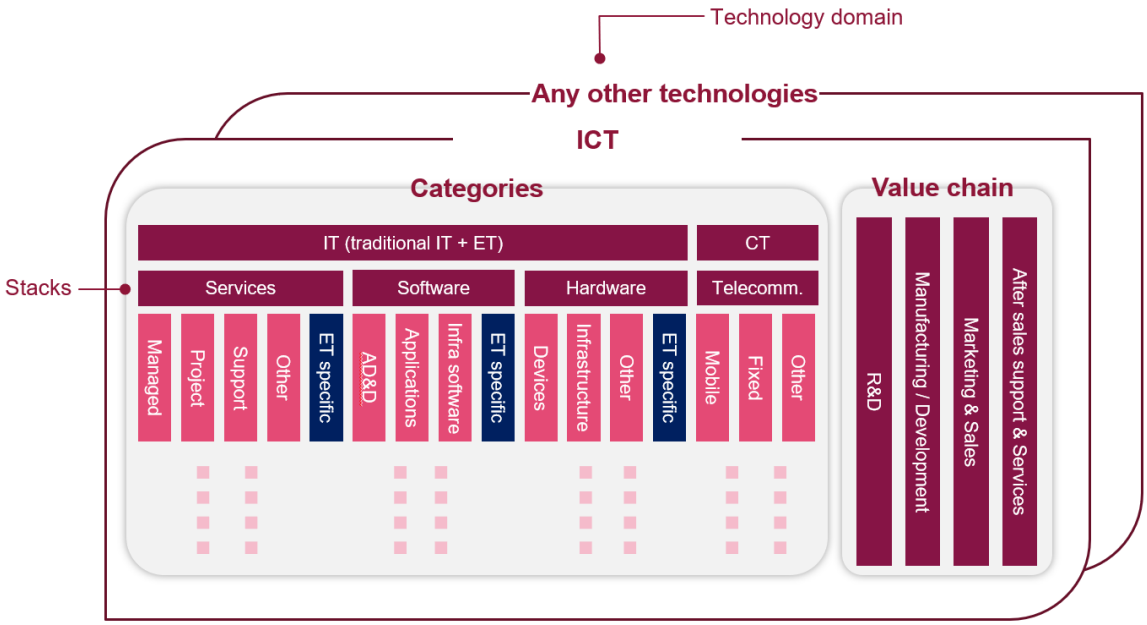

Figure 1: Overview of the ICT Classification Structure

The ICT Classification is designed to be inclusive and activity-based, as businesses could be (and typically are) active across several aspects of the classification (multiple categories and sub-categories of business activities, as well as value chain aspects). It is assumed that underlying

technologies might change, but the activities will remain. Companies expand and develop across the activities defined in the classification, as the spectrum of activities covered by one player may change. For example, trends show telco companies are increasingly developing into multiple IT-related activities and into the IT sector in general.

2. Context

The Government of Qatar delineated its overall development goals in the “Qatar National Vision 2030” and cascaded these goals in its National Development Strategies, highlighting the transformative role the ICT sector needs to play in the future of the country. The CRA is one of the key stakeholders driving the sector’s development guided by the country’s vision. It regulates the ICT sector and supports its competitiveness, with the aim of enabling access to advanced, innovative, and reliable services and balancing the rights of consumers with the objectives of service providers.

Within this context, the CRA Strategy 2020-2024 (CRA Strategy) was designed to fulfil CRA’s mandate and to support the vision and underlying strategies by building the foundations for a knowledge-based economy through the ICT sector.

The CRA Strategy highlights the need to develop comprehensive sector performance measurements and includes, in its list of initiatives, the launch of an ICT sector survey dedicated to fill the data and information gap related to the industry, with a focus on the Information Technology sub-sector where such gap is most substantial.

This document aims to provide a comprehensive and relevant taxonomy principles and categories for Qatar’s ICT sector by analyzing various international methodologies and tailoring a best-of-breed approach to the local Qatari context and CRA purposes. The ICT Classification will serve as a foundation for conducting further regular cycles of the ICT Survey and for prospective sector assessment and analysis.

The Classification will also support and enable further CRA initiatives, including building a comprehensive data base of Qatar’s ICT businesses and making available a published list of the active market players with their business activities categorized as per this sector classification.

3. Objectives

The ICT Classification serves the following main objectives:

1) Create sector specific categorization for Qatar's ICT sector to comprehensively cover locally provided ICT products and services and serve as a base to rank and assess the level of business maturity of the overall sector and individual industry players and registered enterprises.
2) Establish a national framework to better understand Qatar's ICT market that is open, structured and informative for all industry stakeholders, and to support further development of relevant and state-of-art sector governance models, policies, and regulations.
3) Provide guidance for companies in the ICT sector on mapping their ICT products and services against an established sector classification including where on the value chain their business stands.
4) Enable all stakeholders to better assess the overall sector and conduct outcome-driven analyses (including market maturity assessments, value chain analyses, demand/supply gap analyses across categories, investment gap analyses) and provide a base for further market segmentation and policy development.

In the subsequent chapters, this ICT Classification has been detailed to discuss the following:

a. Background on the ICT sector definition as per the CRA Strategy
b. Approach and methodology, including references and best practice, guiding principles and applied criteria.
c. Detailed description of the classification structure and definitions.
d. Linkage to other classifications, e.g., ISIC codes, illustrative use cases.

4. Scope

OECD defines the ICT sector as combining manufacturing and services industries whose products primarily fulfil or enable the function of information processing and communication by electronic means, including transmission and display. The ICT sector contributes to technological progress, output and productivity growth. As per OECD, its impact can be examined in several ways: directly, through its contribution to output, employment or productivity growth, or indirectly, as a source of technological change affecting other parts of the economy[1].

For building this ICT-specific taxonomy, the domains considered under the so-called "technology umbrella" are described below:

1) Information Technology (IT)

IT comprises of both traditional Information Technology and Emerging Technologies (ET)[2]. The term "Emerging Technologies" has been widely adapted and shall be understood as a reference to technology that has a development and/or application that is figuratively emerging into prominence; the term helps to differentiate between relatively new and established technologies. Therefore, traditional IT and ET are considered as follows:

a. Traditional Information Technology refers to the use of any computers, storage, networking and other physical devices, infrastructure, and processes to create, process, store, secure and exchange all forms of electronic data.

b. Emerging technologies (ET) are innovative technologies that have been recently developed, are under development, or will be developed within the next few years, and that are creating, or are expected to create, significant social or economic effects.

   Seven key ET areas have been identified and shortlisted based on secondary research and expert guidance to identify technology areas that (a) have a potential strong future impact

[1] https://www.oecd-ilibrary.org/science-and-technology/information-and-communication-technology-ict/indicator-group/english_04df17c2-en#:~:text=The%20ICT%20sector%20combines%20manufacturing,progress%2C%20output%20and%20productivity%20growth.

[2] In this document, Emerging Technologies are meant to include only fundamental technologies, no technology concepts, such as digital twins or metaverse.

on the sector, (b) have a current substantial growth of perceived relevance, (c) are balanced towards being distinct on the one hand and exhaustive on the other hand, (d) can be examined along the entire technology stack (hardware/infrastructure, software, services):

- Cybersecurity
- Big Data and Artificial Intelligence / Machine Learning
- Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality)
- Internet of Things (IoT) / Machine-to-Machine (M2M)
- Blockchain / Distributed Ledger
- Edge & Cloud computing
- Other Emerging Technologies, including but not limited to Next Gen Networks (e.g., laser and quantum communications), Next Gen Computing (e.g., quantum computing).

Each of the above mentioned ET areas refers to a theme that encompasses multiple underlying technologies for classification purposes. While Cybersecurity for instance is not a specific technology itself, the term refers to the underlying technologies, i.e., technologies linked to the protection of computer systems and networks.

This ICT Classification considers a wider scope of ET compared to what the CRA Strategy has considered, further detailing the ICT sector definition through incorporating additional relevant technologies and thus leading to a more holistic scope and approach to comprehending the sector (See Figure 2).

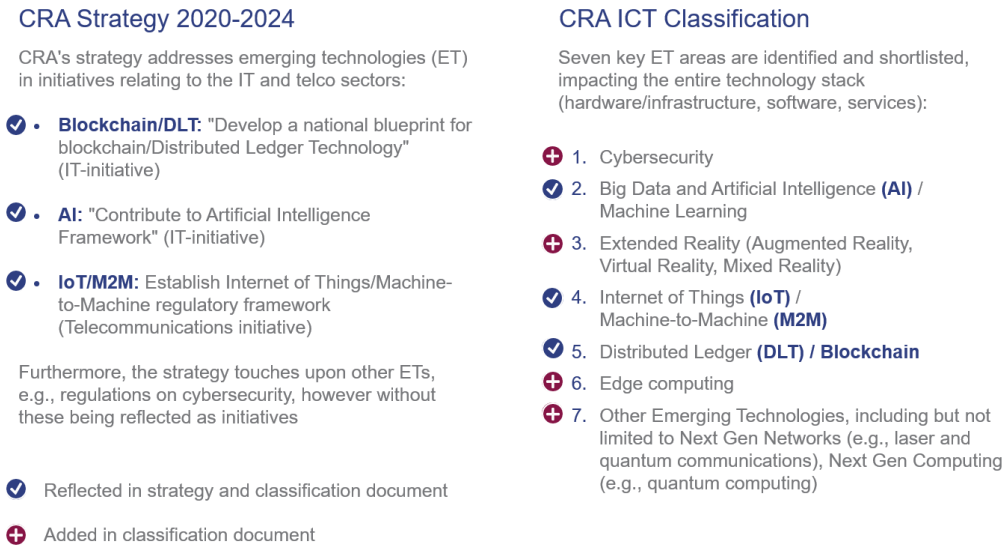

Figure 2: Comparison of Emerging Technologies list of CRA Strategy 2020-2024 and the current ICT Classification

2) Communications Technology (CT)

CT is defined as technologies related to offering services which provide access to voice, internet, and data services through telecommunications networks and inclusive of all telecommunications standards (fixed, mobile, satellite, etc.). Communications technology and telecommunications are used interchangeably in this document.

CT as a category generally refers to a far less companies than IT, i.e., mainly large telecommunication companies and licensed telecommunications networks and service providers. However, CT is maintained as a separate category due to following reasons:

a. The size and relevance of the telecommunications sector are still significant, both for the overall economy as well from the perspective of an enabler of the IT sector
b. Including a telecommunications category is aligned with leading benchmarks, e.g., the ISIC classification.
c. It allows visibility to track the shift of telecommunication-based businesses towards provision of IT products and services.

d. It falls into CRA's mandate to regulate Qatar's telecommunications sector; thus, CT is included in the ICT classification.

3) Operating Technologies (OT)

OT refers to technologies which are used in industrial setups and environments (such as Scada). OT is outside the scope of CRA as per the CRA Strategy and therefore not considered for the ICT classification. However, if a future strategy revision or market evidence suggest encompassing OT, it may be added as an additional layer.

In summary, for the above-mentioned purposes and based on all relevant references and applicable definitions, the ICT sector has thus been defined to be comprised of Information Technology (IT), including both Traditional Information Technology and Emerging Technologies, and the Communications Technology sector (CT).

5. Background

CRA's mandate as a regulator of the ICT sector and the sector definition as provided by the CRA Strategy have been the starting point for defining and shortlisting the business activities to be included in the ICT sector classification.

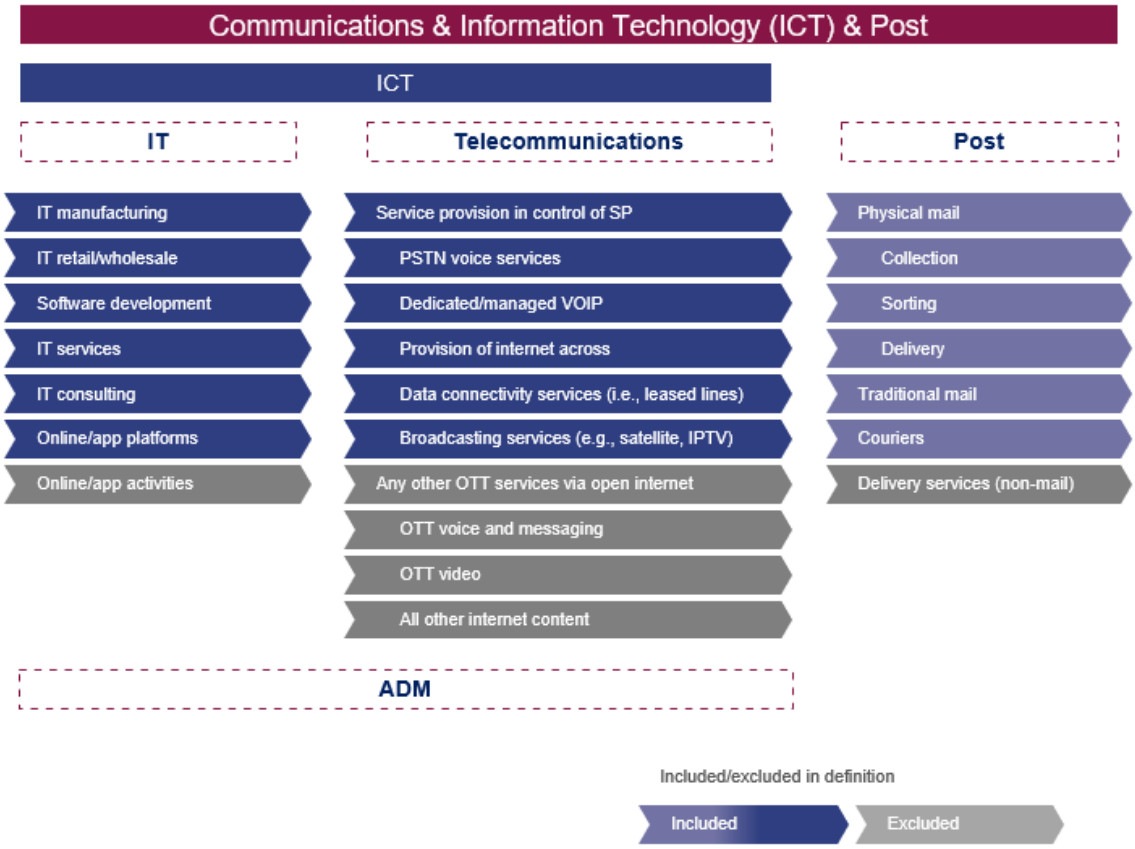

Figure 3: CRA Strategy 2020-2024, ICT sector definition

In the Strategy document, the ICT sector is defined to cover two main pillars: IT and telecommunications. Whilst IT includes IT manufacturing, IT retail, IT services, IT consulting, among others, telecommunications include provision of internet access, data connectivity services, among others (See Figure 3). Telecommunications shall be referred to Communications Technology (CT) as both terms are used interchangeably.

The CRA Strategy recommends further detailing the ICT sector definition. The ICT Classification addresses this particular Strategy's recommendation and further structures the sector into multiple, more detailed levels of ICT categories, while an additional layer of the ICT value chain is introduced too.

6. Methodology and Approach

This chapter explains how the current ICT classification has been developed:

- highlighting the current limitations that drive the need for new ICT taxonomy principles and categories and
- describing the key principles and general approach for setting up the suggested classification system.

The ICT classification detailed in this document has been developed as part of the research framework design for the CRA ICT Sector Research Study 2022. The classification categories and principles have been validated through the CRA ICT Survey conducted between March and June 2022. The overall categories structure and logic have been refined as per feedback from the survey respondents on their ability to classify their business activities.

The current ICT classification has been finalized based on further inputs received from key stakeholders, including the Planning and Statistics Authority and the licensing platforms in Qatar within the public consultation (conducted between September and December 2022) on the relevance of the classification in the context of Qatar's ICT market.

6.1 Initial situation

The need for a new industry taxonomy for the Qatar ICT sector is clear. Currently, a detailed classification system that reflects the specific market perspective and regulatory requirements is missing. Most government registers and databases[3] available in Qatar and relevant to the ICT sector apply non-sector specific categories, mostly on the United Nations ISIC coding system, which presents obvious limitations when applied in terms of categorization and in-depth analysis of the ICT industry.

The ISIC taxonomy does not provide a specific directory for the ICT sector – instead, it encompasses all sectors' economic activities. As much as there is a dedicated Section J Information and Communication, which also includes media-related activities, such as publishing and content

[3] For example, PSA national accounts, MOCI business registration process, CRA ICT sector reports and measurements, etc.

production. Therefore, the ISIC-based proxy definition for ICT lacks precision and granularity and cannot be fully aligned with the CRA Strategy ICT definition. It also fails to include some other important ICT-related business activities, e.g., ICT-specific hardware manufacturing. Hence, using the ISIC Section J Information and Communication coding categories as a classification structure is found not suitable, nor sufficient (See Table 11 in the Appendix).

Alternatively, another ISIC directory can be referred to the ICT sector, as an aggregation for the ICT sector" (See Table 10 in the Appendix). However, it also has limitations in defining ICT activities. It is not a directory, but an aggregation of ICT-related ISIC codes, and it does not have a cascaded structure that can move from higher to more granular levels of detail.

Further to the above, the latest ISIC revision was published by the United Nations Statistics Division in 2008[4]. Therefore, it has limitations in classifying new ICT products and services that have emerged in the market over the past 10+ years and are currently core drivers of the ICT industry development. For example, software has diversified in many directions to serve various new market demands and use cases, but only one ISIC code (5820) for software publishing exists. More generally, most relevant segments demand more granularity to reflect current market developments.

Therefore, to overcome the limitations of the ISIC classification — not allowing relevant sector segmentation and depth, measurements, or analysis — a new taxonomy was found necessary to be defined. This new ICT-specific classification system is aimed to overcome the existing limitations of the ISIC code-based system, as well as serve the purpose of CRA as an ICT regulator and key use cases for both government policy makers and sector players more generally.

6.2 Key principles

The developed ICT Classification is based on the following general guiding principles:

1) Comprehensiveness - ensure it covers all main and subsidiary business activities and services of the ICT sector.

[4] Source: ISIC revision 4, United Nations, Statistics Division (2008), https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf

2) Exclusiveness - ensure no overlaps exist among the different categories to avoid one service/product being classified into multiple categories.
3) International perspective - secure comparability with other country/regional market data by being aligned with other relevant international classifications.
4) Future readiness - reflect new and high-impact market trends based on new technologies; be flexible and accommodating of future ICT sector changes.
5) Granularity - structure classification in multiple layers (category levels) to be comprehensive and layered enough to reflect the full range of business activities within the ICT sector.
6) Relevance - contain enough relevant ICT-tailored components, instead of staying on a general/aggregated level, relevant in local market context.

The ICT Classification follows a balanced approach across five dimensions of considerations (See Figure 4) and aims to…

A) … strike a balance between simplicity vs. complexity of categorization.
B) … support both the measurement of the ICT sector in Qatar, as well as its development
C) … focus both on categories that are relevant in Qatar today, as well as on currently small categories with a high growth and/or future potential for Qatar.
D) … include current technologies while ensuring it can be updated regularly with potential future technologies.
E) … strike a balance between the comparability of categories to other countries whilst tailoring the categorization to Qatar's structure and requirements.

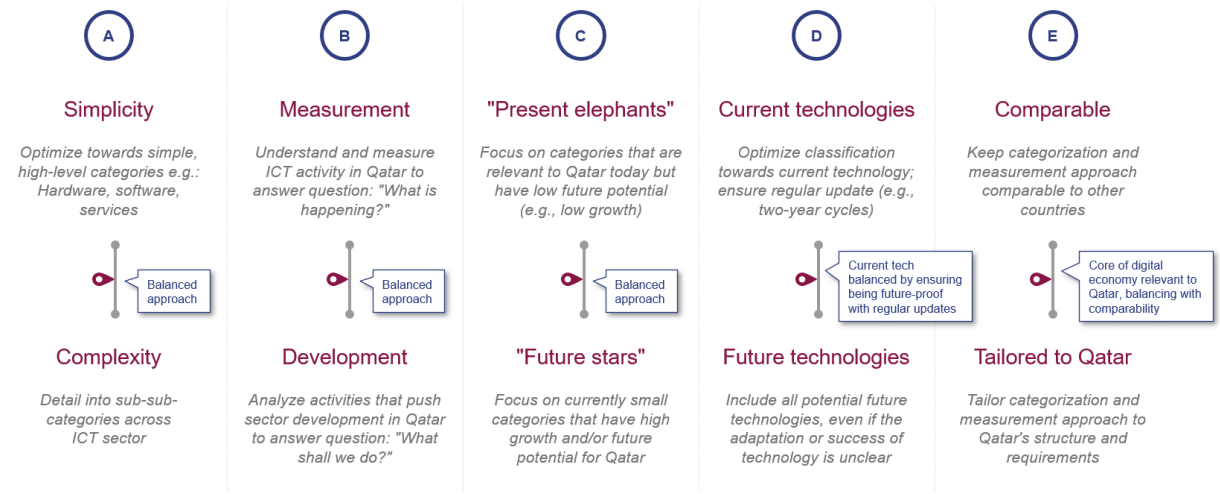

Figure 4: Multi-dimensional balanced approach for the ICT Classification

6.3 Taxonomy development approach

To gain a better understanding, various ICT taxonomy references have been listed based on research on the available international classification standards and best practices from benchmark countries and relevant peers. The key references considered include[5]:

- Global Industry Classification Standard
- International Standard Industrial Classification (ISIC)
- North American Industry Classification System
- UK Standard Industrial Classification
- KSA CITC IT/ET Sector Classification

[5] https://www.msci.com/our-solutions/indexes/gics#:~:text=GICS%C2%AE%20is%20an%20industry,consistent%20and%20exhaustive%20industry%20definitions.

https://unstats.un.org/unsd/classifications/Econ/isic

https://www.naics.com/

https://www.ons.gov.uk/methodology/classificationsandstandards/ukstandardindustrialclassificationofeconomicactivities

https://www.citc.gov.sa/en/services/tech/PublishingImages/Pages/default/ITETSectorClassification.pdf

https://www.idc.com/getdoc.jsp?containerId=IDC_P336

https://doi.org/10.1787/ab16c396-en

- IDC Worldwide Black Book Taxonomy
- OECD taxonomy and definition of ICT sector

The above references have been shortlisted based on the key principles mentioned in Section 6.2 above. These principles are seen as criteria to evaluate each referenced classification, as follows:

- International perspective: level of comparability against other available data under the same classification; the more worldwide use, the better.
- Being up-to-date: extent of capturing new market trends, market dynamics, and shifting business trends in the ICT industry.
- Serve required level of granularity: level of hierarchies and details. The more hierarchies in the structure the better the ability to segment the market into multiple levels; also, the more sub-segments the more detailed categorization is possible.
- Relevance for ICT sector: level of comprehensiveness and applicability for the ICT sector.

Assuming that each criterion is equally important, the following three references have been shortlisted (See Figure 5):

1) International Standard Industrial Classification (ISIC)

   ISIC is considered the backbone of industry classifications globally. For example, the North American Industry Classification System (NAICS) has an official mapping with ISIC to build connectivity. As mentioned earlier, it also applies as a base for alignment with existing classification systems in Qatar. Therefore, while the ISIC system is neither up-to-date, nor entirely relevant to the ICT sector, it brings a significant background in establishing the basic context and logic.

2) KSA CST Information Technology and Emerging Technologies (IT/ET) Sector Classification

   Since KSA is a regional peer, its sector performance and governance present many comparable characteristics, with direct implications on the sector taxonomy (albeit more tailored to IT than ICT). Released in March 2021, the Saudi Arabia's Space &Technology Commission sector classification system is equally focused on Emerging Technologies, which makes it future-oriented. However, whilst long-refined conversion tables allow

comparability between more established taxonomies, the KSA sector classification lacks comparability to other classification systems.

3) IDC Black Book Taxonomy

Among leading research institutions' ICT classifications, IDC Taxonomy is considered as the most relevant reference in the current context. IDC taxonomy is future-oriented and reflects on various new market trends. Furthermore, it is specific to the ICT sector, so its relevance and granularity are higher than others. It is the most fitting classification approach for the objectives articulated in both the CRA mandate and the key principles established in this document. Another expected benefit is the possibility of leveraging IDC research data for market sizing and benchmarking purposes[6].

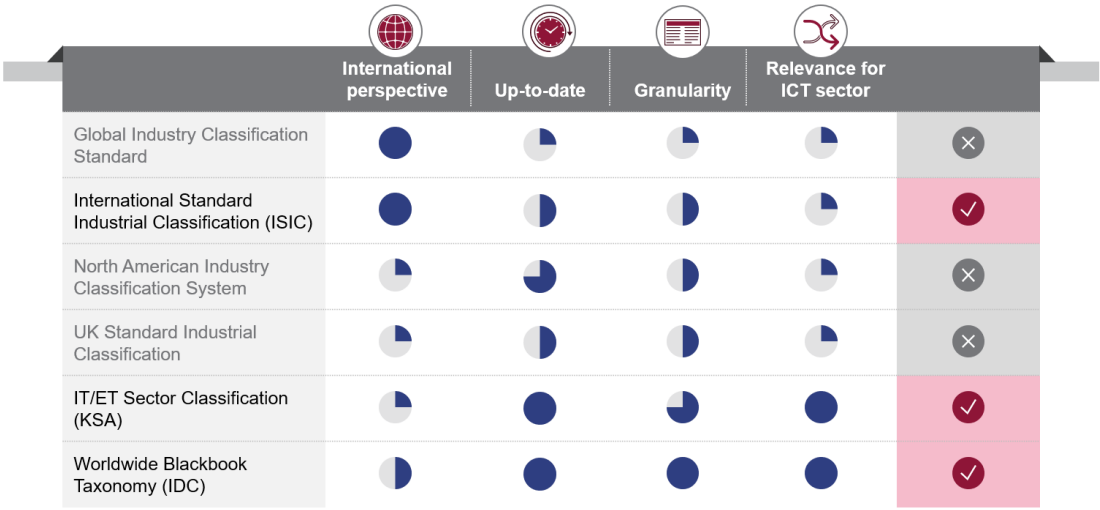

Figure 5: Shortlisted ICT Classification References

Guided by the key principles detailed in Section 6.2, our approach builds on the shortlisted classification references to incorporate best practices and tailor them to the needs to the local market, ensures emerging technologies are effectively reflected to future-proof the ICT classification and its use, and adds a value chain dimension to enable policy-driven sector development analyses. The outcome of the approach is presented in the next chapter.

[6] As IDC market data for Qatar is not available, direct benchmark is not possible, which limits the usability and data availability, but emphasizes the importance and potential relevance of this classification for Qatar

In the future, the ICT classification established with this document will be subject to periodic reviews by the CRA, which may take revisions and updates of the referenced classifications and approach, as necessary. In addition, the Classification may need to be further assessed in line with the latest developments in the ICT products and services sector supplied globally and to Qatar's market and, as such, updated accordingly.

7. ICT Classification Overview

7.1 Overall structure and principles

As mentioned above, the ICT sector taxonomy has three levels of granularity: Category 1, Category 2, and Category 3. Adjacent to these three categories, a horizontal layer of value chain activities (e.g., R&D, sales) is added to map the business profiles of local market players across all categories. Understanding local players' focus and activities across the value chain elements is important from a regulatory perspective and such extra classification layer shall provide the necessary visibility and base for further assessment and analysis.

The general ICT Classification structure is visualized in Figure 1. It is designed as flexible and future-proof: it can accommodate new technologies, e.g., by categorizing a new technology as part of the ETs, by adding a new layer, or by adding a new canvas on top of ICT, which would follow the same structure of categories and value chain layer, but could encompass any other technologies. Thus, the modular structure gives room for future adjustments to reflect on new market trends or additional technologies to be considered.

The ICT Classification is designed to be inclusive and activity-based as companies can be (and typically are) active across several aspects (multiple categories and sub-categories, as well as value chain aspects). It is assumed that underlying technologies might change, but the activities will remain. Companies are expected to expand and develop across the activities defined in the Classification, as the spectrum of activities covered by one player may change over time (See Figure 1).

7.2 Category 1 Overview

Category 1 consists of three main segments under the domain of IT and one segment for CT (See Table 1).

	Category 1	Clarification
IT & ET	Services	Any value chain activity in ICT-specific services (R&D / service packaging / sales & marketing / after sales support)
	Software (including platforms)	Any value chain activity (R&D / development / sales & marketing / after sales support & service activities) in applications, applications deployment and development, and infrastructure software
	Hardware (including infrastructure)	Any value chain activity (R&D / manufacturing / sales & marketing / after sales support & service activities) in devices, and infrastructure equipment, other
CT	Telecommunications services	Any value chain activity (R&D / manufacturing / sales & marketing / after sales support & service activities) in telecommunications, including fixed / mobile / other infrastructure or data/voice providers

Table 1: ICT Classification Category 1

For the sake of clarity, it is important to note that in the Classification structure, “Services” are seen both from an ICT activity-based category perspective, as well as from a value chain perspective (See Figure 1). Thus, Category 1 “Services” includes activities of ICT-specific services (i.e., services that assist in the implementation, management, and operation of computer systems, network equipment, software, etc.). The value chain step “After Sales Support & Services” applies to all categories, including the category “Services”. For example, for IT this value chain step refers to support provided to a customer after the product or service has already been purchased; for CT it includes installations and claim handling, etc.

7.3 Categories 2 and 3 Overview

Category 2 consists of 15 segments and Category 3 consists of 60 segments representing ICT specific activities, with an additional layer to reflect on the value chain activities (See Table 2). Definitions of the business activities included under these categories are described in the next chapter.

Category 1	Category 2	Category 3	Value chain			
			R&D	Manufact. / Develop.	Sales	After sales support & service
Services	Traditional IT Managed services	Technology outsourcing				
	Traditional IT Project oriented	Application development				
		IT consulting				
		Systems and network implementations				
	Traditional IT Support services	IT deployment and support				
		IT education and training				
	Other traditional IT services	Other				
	Emerging Technologies (ET) specific services	Cybersecurity services				
		Big Data and Artificial Intelligence / Machine Learning services				
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) services				
		Internet of Things / Machine-to-Machine (M2M) services				
		Blockchain / Distributed Ledger services				
		Edge & Cloud Computing services				
		Other Emerging Technologies specific services				
Software (including platforms)	Traditional IT application development and deployment	Analytics and business intelligence				
		Application development software				
		Application platforms				
		Data management software				
		Integration and orchestration middleware				
		Software quality and lifecycle tools				

Category 1	Category 2	Category 3	Value chain			
			R&D	Manufact. / Develop.	Sales	After sales support & service
		Other traditional IT application deployment and development				
	Traditional IT applications	Collaborative applications				
		Content workflow and management applications				
		Customer Relationship Management (CRM) applications				
		Engineering applications				
		Enterprise Resource Management (ERM) applications				
		Production applications				
		Supply Chain Management (SCM) applications				
		Other traditional IT applications				
	Traditional IT infrastructure software	Endpoint management software				
		Network software				
		Physical and virtual computing software				
		Storage software				
		System and service management software				
		Other traditional IT infrastructure software				
	Emerging technologies (ET) specific platforms and software	Cybersecurity platforms and software				
		Big Data and Artificial Intelligence / Machine Learning platforms and software				
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) platforms and software				
		Internet of Things / Machine-to-Machine (M2M) platforms and software				

Category 1	Category 2	Category 3	Value chain			
			R&D	Manufact. / Develop.	Sales	After sales support & service
		Blockchain / Distributed Ledger platforms and software				
		Edge & Cloud Computing platforms and software				
		Other ET specific platforms and software				
Hardware (including infrastr.)	Traditional IT devices	Phone				
		Peripheral				
		Personal computing device				
	Traditional IT infrastructure	Network equipment				
		Server/storage				
	Other traditional IT hardware and infrastructure	Other hardware and infrastructure which does not fit to Devices / Infrastructure				
	Emerging technologies (ET) specific hardware and infrastructure	Cybersecurity hardware and infrastructure				
		Big Data and Artificial Intelligence / Machine Learning hardware and infrastructure				
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) hardware and infrastructure				
		Internet of Things / Machine-to-Machine (M2M) hardware and infrastructure				
		Blockchain / Distributed Ledger hardware and infrastructure				
		Edge & Cloud Computing hardware and infrastructure				
		Other Emerging Technologies specific hardware and infrastructure				

Category 1	Category 2	Category 3	Value chain			
			R&D	Manufact. / Develop.	Sales	After sales support & service
Tele-communication Services	Fixed	Voice				
		Data				
	Mobile	Voice				
		Data				
	Other	Other (including non-terrestrial networks, e.g., HAPS, LEO satellites)				

Table 2: ICT Classification Categories 2 and 3 with Value Chain Activities Layer

8. ICT Classification Categories and Value Chain Activities Definitions

The following tables provide definitions across all Category 1 verticals (IT Services, IT Software, IT Hardware, and Telecommunications Services) and further detailing them on Category 2 and 3 levels.

8.1 IT Services

Below Table 3 provides the definitions for the business activities under Information Technology Services (Category 1), across Category 2 (inclusive of five segments) and Category 3 (inclusive of fourteen segments).

Category 1: IT Services			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition[7]**
Traditional IT Managed services	Long-term, contractual arrangement in which a service provider takes ownership of managing all or part of a client's information systems infrastructure and operations based on a service-level agreement (recurrent support)	Technology outsourcing	• Key horizontal BPO (customer care business process, finance & accounting process, HR process, procurement process outsourcing) • Application management • Hosted application management • Hosted infrastructure services • IT outsourcing • Network and endpoint outsourcing services • Pro-active monitoring of System/Services
Traditional IT Project oriented	Project-based IT services to 1) develop customized code sets to meet a client's business needs, 2) improve organizational IT performance, 3) deliver technical solution that addresses an organization's specific technical or business needs	Application development	• Custom application development
		IT consulting	• IT consulting (business of providing IT-related expert advice), e.g., assessment of IT infrastructure and architecture and design of IT infrastructure)
		Systems and network implementations	• Network consulting and integration • Systems integration • Pro-active monitoring of System/Services
Traditional IT Support services	IT support that helps to install and deploy hardware and software as well as IT education/training	IT deployment and support	• Hardware deployment and support • Software deployment and support
		IT education and training	• IT education and training (business of providing IT-related knowledge and skills, e.g., through trainings and teaching)
Other traditional IT services	Other traditional IT services	Other	• Other traditional IT related services
Emerging Technologies (ET) specific services	Services related to the seven Emerging Technologies (ET) areas identified for IT sector	Cybersecurity services	• Services for protecting networks, devices, and data from unauthorized access or criminal use • Services for ensuring confidentiality, integrity, and availability of information

[7] Sources: Based on desktop research of specific category, including dictionaries

Category 1: IT Services			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition[7]**
	Emerging Technologies are innovative technologies that have been recently developed, are under development or will be developed within the next few years, and that are creating, or are expected to create, significant social or economic effects	Big Data and Artificial Intelligence / Machine Learning services	• Services for the use of processes and technologies, including AI and ML, to combine and analyze massive datasets with the goal of identifying patterns and developing actionable insights.
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) services	• Services for all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables
		Internet of Things (IoT) / Machine-to-Machine (M2M) services	• Services for any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans
		Blockchain / Distributed Ledger services	• Services for distributed ledger type of databases that are shared, replicated, and synchronized among the members of a decentralized network
		Edge and Cloud Computing services	• Services for edge computing which is the deployment of computing and storage resources at the location where data is produced • Services for cloud computing which is the delivery of computing services and solutions (e.g., storage, database, analytics) real-time, over the internet and on demand
		Other Emerging Technologies (ET) services	• Services for Next Gen. Networks (e.g., laser and quantum communications) and Next Gen. Computing (e.g., quantum computing) • Other ET specific services

Table 3: ICT Classification: IT Services Definitions

8.2 IT Software (including Platforms)

The below Table 4 provides definitions for business activities under IT Software (Category 1), across four segments at Category 2 level and more than twenty Category 3 segments.

Category 1: IT Software (including Platforms)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
Traditional IT application development and deployment	Tools and platforms used primarily by developers to build, test, and deploy software as well as process, govern, and analyze data	Analytics and business intelligence	• Advanced and predictive analytics software • End-user query, reporting, and analysis • Spatial information systems
		Application development software	• Business rules management systems • Development language, environments, and tools • Modeling and architecture tools • Software construction components
		Application platforms	• Deployment-centric application platforms • Model-driven application platforms • Robotic process automation software • Transaction processing monitors
		Data management software	• Database administration and development tools • Data integration and intelligence software • Data management systems
		Integration and orchestration middleware	• Business-to-business middleware • Event stream processing software • Integration software • Managed file transfer software
		Software quality and lifecycle tools	• Automated software quality • Software change, configuration, and process management
		Other	• Other traditional IT related application development and deployment

Category 1: IT Software (including Platforms)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
Traditional IT applications	Commercial, industrial, and technical programs and code sets designed to automate specific sets of business processes in an industry or business function and make groups or individuals in the organization more productive or support education or data processing in personal activities	Collaborative applications	• Conferencing applications • Email applications • Enterprise community applications • Team collaborative applications
		Content workflow and management applications	• Capture applications • Content sharing and collaboration applications • Creative applications • Document applications • Discovery applications • Enterprise content management applications • Enterprise portals • Persuasive content management applications
		Customer relationship management (CRM) applications	• Advertising applications • Contact center applications • Customer service applications • Digital commerce applications • Marketing campaign management applications
		Engineering applications	• Collaborative product data management applications • CAD/CAE/CAM applications
		Enterprise resource management (ERM) applications	• Enterprise asset management applications • Enterprise performance management applications • Financial applications • Human capital management applications • Order management applications • Payoff management applications • Procurement applications • Project and portfolio management (PPM) applications
		Production applications	• Other operations applications • Production and grid management applications • Service industry and public sector applications

Category 1: IT Software (including Platforms)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
		• Supply chain management (SCM) applications	• Inventory management applications • Logistics applications • Production planning applications
		• Other	• Other traditional IT related applications
Traditional IT infrastructure software	Software solutions that provide the basic foundational layers of software that enable bare metal infrastructure hardware resources to host higher-level application development / deployment software / application software and provide virtualization / management software and share the use of those resources	• Endpoint management software	• Client endpoint management • Output management tools
		• Network software	• Network infrastructure software • Network management software
		• Physical and virtual computing software	• Operating systems and subsystems • Other computing software • Software-defined computing software • Virtual client computing
		• Storage software	• Archiving software • Data replication and protection • Software-defined storage controller software • Storage and device management software • Storage infrastructure software
		• System and service management software	• IT automation and configuration management software • IT operations and management software • IT service management software
		• Other	• Other traditional IT infrastructure software
Emerging Technologies (ET) specific Platforms and Software	Platforms and software related to the seven Emerging Technologies (ET) areas identified for IT sector; Emerging Technologies are innovative technologies that have been recently developed, are under development or	• Cybersecurity platforms and software	• Platforms and software for protecting networks, devices, and data from unauthorized access or criminal use • Platforms and software for ensuring confidentiality, integrity, and availability of information
		• Big Data and Artificial Intelligence / Machine Learning platforms and software	• Platforms and software for the use of processes and technologies, including AI and ML, to combine and analyze massive datasets with the goal of identifying patterns and developing actionable insights.
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) platforms and software	• Platforms and software for all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables

Category 1: IT Software (including Platforms)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
	will be developed within the next few years, and that are creating, or are expected to create, significant social or economic effects	Internet of Things (IoT) / Machine-to-Machine (M2M) platforms and software	• Platforms and software for any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans
		Blockchain / Distributed Ledger platforms and software	• Platforms and software for distributed ledger type of databases that are shared, replicated, and synchronized among the members of a decentralized network
		Edge Computing and Cloud Computing platforms and software	• Platforms and software for edge computing which is the deployment of computing and storage resources at the location where data is produced • Platforms and software for cloud computing which is the delivery of computing services and solutions (e.g., storage, database, analytics) real-time, over the internet and on demand
		Other Emerging Technologies (ET) specific Platforms and Software	• Platforms and software for Next Gen. Networks (e.g., laser and quantum communications) and Next Gen. Computing (e.g., quantum computing) • Other ET specific platforms and software

Table 4: ICT Classification: IT Software Definitions

8.3 IT Hardware (including Infrastructure)

Table 5 below provides definitions for business activities under IT Hardware (Category 1), across Category 2 level (inclusive of four segments), and thirteen Category 3 segments.

Category 1: IT Hardware (including Infrastructure)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
Traditional IT Devices	Instruments that use electric current to encode, analyze, or transmit information	Phone	• Feature/analogue phone (portable phone that can make and receive calls and texts but with limited other functionalities) • Smartphone (portable phone that includes computing functions)
		Peripheral	• Hardcopy peripheral • PC monitor

Category 1: IT Hardware (including Infrastructure)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
		Personal computing device	• Desktop • Notebook • Tablet
Traditional IT Infrastructure	Hardware needed for network or server/storage	Network equipment	• Electronic devices required for communication, interaction, and data transmission on a computer network
		Server/storage	• External storage system • Non-x86/x86 server
Other traditional IT Hardware and Infrastructure	Other hardware which does not fit to traditional IT Devices or Infrastructure	Other traditional IT Hardware	• Other hardware which does not fit in above categories (e.g., radars, frequency jammers, TETRA radio, VHF and UHF radios)
Emerging Technologies (ET) specific Hardware and Infrastructure	Hardware and Infrastructure related to the seven Emerging Technologies (ET) areas identified for IT sector Emerging Technologies are innovative technologies that have been recently developed, are under development or will be developed within the next few years, and that are creating, or are expected to create, significant social or economic effects	Cybersecurity hardware and infrastructure	• Hardware and infrastructure for protecting networks, devices, and data from unauthorized access or criminal use • Hardware and infrastructure for ensuring confidentiality, integrity, and availability of information
		Big Data and Artificial Intelligence / Machine Learning hardware and infrastructure	• Hardware and infrastructure for the use of processes and technologies, including AI and ML, to combine and analyze massive datasets with the goal of identifying patterns and developing actionable insights
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) hardware and infrastructure	• Hardware and infrastructure for all real-and-virtual combined environments and human-machine interactions generated by computer technology and wearables
		Internet of Things (IoT) / Machine-to-Machine (M2M) hardware and infrastructure	• Hardware and infrastructure for any technology that enables networked devices to exchange information and perform actions without the manual assistance of humans
		Blockchain / Distributed Ledger hardware and infrastructure	• Hardware and infrastructure for distributed ledger type of databases that are shared, replicated, and synchronized among the members of a decentralized network

Category 1: IT Hardware (including Infrastructure)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
		Edge Computing and Cloud Computing hardware and infrastructure	• Hardware and infrastructure for edge computing which is the deployment of computing and storage resources at the location where data is produced • Platforms and software for cloud computing which is the delivery of computing services and solutions (e.g., storage, database, analytics) real-time, over the internet and on demand
		Other Emerging Technologies (ET) hardware and infrastructure	• Hardware and infrastructure for Next Gen. Networks (e.g., laser and quantum communications) and Next Gen. Computing (e.g., quantum computing) • LTE communication technology with dedicated frequencies for organization • Other ET specific hardware and infrastructure (e.g., LTE communication technology with dedicated frequencies for organization)

Table 5: ICT Classification: IT Hardware definitions

8.4 CT: Telecommunications Services

Below Table 6 provides definitions for business activities under Communications Technology domain referring to Telecommunications Services (Category 1) and across Category 2 (inclusive of three segments) and for five Category 3 segments.

Category 1: Telecommunications Services			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
Fixed	Wired telecommunications service	Voice	• Transport of voice traffic over the public switched telephone network (PSTN) and integrated services digital network (ISDN)
		Data	• Provide access to the global IP network, or internet, for web browsing and communications applications • Connectivity only (dial up, broadband such as DSL, cable)

Category 1: Telecommunications Services			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
			• Fixed wireless connections purchased from an ISP network provider (Wi-Fi and WiMAX) • Submarine telecommunications cable connectivity
Mobile	Wireless tele-communications service	Voice	• Mobile services related to voice
		Data	• Packaged data services for IP mobile devices
Other	Mainly Non-Terrestrial Network (NTN), incl. HAPS, LEO, satellites etc.	Other (Including non-terrestrial networks)	• Other, mainly Non-Terrestrial Network (NTN), incl. HAPS, LEO, satellites etc.

Table 6: ICT Classification: Telecommunications Services Definitions

8.5 Value chain activities

Below Table 7 provides lists examples for each value chain activity that is added as an additional layer on the ICT classification. It is worth noting once again that this layer gives substantial value to CRA (as regulator) in terms of providing visibility to local companies' business activities across the value chain and shedding light on different business models present in the local market. Accordingly, this could enable targeted market assessment and regulatory approach for the local ICT market in the future.

Domain	Value chain	Clarifying examples
Traditional Information Technology (IT) and Emerging Technologies (ET)	R&D	• Potential application validated • Proof-of-Concept demonstrated, analytically and/or experimentally • Component and/or breadboard laboratory validated • Component and/or breadboard validated in simulated or real environment • System adequacy validated in simulated environment • System adequacy validated in application
	Manufacturing (hardware) / Development (software)	• Involved in hardware manufacturing process related activities (engineering validation testing, design validation testing, product validation testing, mass manufacturing, and assembly) • Involved in software development cycle activities (planning, creating, testing and deploying)

Domain	Value chain	Clarifying examples
	Marketing & Sales	• Distribute products through different channels • Develop strategies to target relevant customers Define pricing strategy (e.g., software licensing and pricing) • Define communications and advertising strategy • Set up sales performance metrics and ROI analysis • Define support and operations strategy
	After sales support & service	• Installation and implementation services • Any support provided to a customer after the product or service has already been purchased (e.g., sales of spare parts, customer support, warranty) • Post-life cycle management (e.g., recycling)
Tele-communications Services	R&D	• Research and development of advanced network features
	Production	• Build up and roll out the network • Network deployment and maintenance • Product or service development
	Marketing & Sales	• Provide wholesale / retail network capacity to consumers, as an operator • Define pricing strategy • Develop strategies to target relevant customers • Define communication and advertising strategy • Set up sales performance metrics and ROI analysis • Define support and operations strategy
	After sales support & service	• Installations • Repair and claim handling • Return and exchange handling • Warranty and replacements

Table 7: ICT Classification Value Chain Activities Definitions

9. Mapping with ISIC

Another important aspect of the classification development is mapping the classification categories to the ISIC codes, given that majority of data, reports and analysis across the Qatari government structures (e.g., PSA, MOCI, etc.) are based on ISIC codes. Therefore, making use of the existing data (for example, MOCI's list of registered businesses) requires such alignment (See Table 8).

The ISIC codes have been mapped against the ICT sector classification in the table below (See Table 8). Every IT-related ISIC code has been clearly mapped, which proves that the recommended classification system is aligned with the United Nation's ISIC definitions. Since ET-related activities are not cascaded down to the same level as traditional IT and CT-related activities, ISIC codes for ET constitute the sum of all ISIC codes (for each specific level 1 category).

Category 1	Category 2	Category 3	Relevant ISIC
IT Services	Traditional IT Managed services	Technology outsourcing	6202
	Traditional IT Project oriented	Application development	6201
		IT consulting	6202
		Systems and network implementations	6202
	Traditional IT Support services	IT deployment and support	9511, 9512
		IT education and training	6202, 8545
	Other traditional IT services	Other	6201, 6202, 6209, 9511, 9512
	Emerging Technologies (ET) specific services	Cybersecurity services	6201, 6202, 6209, 9511, 9512
		Big Data and Artificial Intelligence / Machine Learning services	6201, 6202, 6209, 9511, 9512
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) services	6201, 6202, 6209, 9511, 9512
		Internet of Things / Machine-to-Machine (M2M) services	6201, 6202, 6209, 9511, 9512
		Blockchain / Distributed Ledger services	6201, 6202, 6209, 9511, 9512
		Edge Computing services	6201, 6202, 6209, 9511, 9512
		Other Emerging Technologies specific services	6201, 6202, 6209, 9511, 9512

Category 1	Category 2	Category 3	Relevant ISIC
IT Software (including Platforms)	Traditional IT application development and deployment	Analytics and business intelligence	5820, 4651, 6311
		Application development software	5820, 4651, 6311
		Application platforms	5820, 4651, 6311
		Data management software	5820, 4651, 6311
		Integration and orchestration middleware	5820, 4651, 6311
		Software quality and lifecycle tools	5820, 4651, 6311
		Other traditional IT application deployment and development	5820, 4651, 6311
	Traditional IT applications	Collaborative applications	5820, 4651, 6311
		Content workflow and management applications	5820, 4651, 6311
		Customer Relationship Management (CRM) applications	5820, 4651, 6311
		Engineering applications	2630, 4652, 6311
		Enterprise Resource Management (ERM) applications	2630, 4652, 6311
		Production applications	5820, 4651, 6311
		Supply Chain Management (SCM) applications	5820, 4651, 6311
		Other traditional IT applications	5820, 4651, 6311
	Traditional IT infrastructure software	Endpoint management software	5820, 4651, 6311
		Network software	5820, 4651, 6311
		Physical and virtual computing software	5820, 4651, 6311

Category 1	Category 2	Category 3	Relevant ISIC
		Storage software	5820, 4651, 6311
		System and service management software	5820, 4651, 6311
		Other traditional IT infrastructure software	5820, 4651, 6311
	Emerging Technologies (ET) specific Platforms and Software	Cybersecurity platforms and software	5820, 4651, 6311
		Big Data and Artificial Intelligence / Machine Learning platforms and software	5820, 4651, 6311
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) platforms and software	5820, 4651, 6311
		Internet of Things / Machine-to-Machine (M2M) platforms and software	5820, 4651, 6311
		Blockchain / Distributed Ledger platforms and software	5820, 4651, 6311
		Edge & Cloud Computing platforms and software	5820, 4651, 6311
		Other ET specific platforms and software	5820, 4651, 6311
IT Hardware (incl. infra-structure)	Traditional IT Devices	Phone	2630, 4651
		Peripheral	2640, 2680, 4651, 4652
		Personal computing device	2610, 2620, 4651, 4652
	Traditional IT Infrastructure	Network equipment	2630, 4652, 6311
		Server/storage	2630, 4652, 6311
	Other traditional IT Hardware and Infrastructure	Other hardware and infrastructure which does not fit to Devices / Infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
	Emerging Technologies (ET) specific Hardware and Infrastructure	Cybersecurity hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
		Big Data and Artificial Intelligence / Machine Learning hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311

Category 1	Category 2	Category 3	Relevant ISIC
		Extended Reality (Augmented Reality, Virtual Reality, Mixed Reality) hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
		Internet of Things / Machine-to-Machine (M2M) hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
		Blockchain / Distributed Ledger hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
		Edge & Cloud Computing hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
		Other Emerging Technologies specific hardware and infrastructure	2610, 2620, 2630, 2680, 4651, 4652, 6311
Tele-communication Services	Fixed	Voice	6110, 6190
		Data	6110, 6190
	Mobile	Voice	6120, 6190
		Data	6120, 6190
	Other	Other (including non-terrestrial networks, e.g., HAPS, LEO satellites)	6130, 6190

Table 8: ISIC codes aligned to ICT Classification Categories 1-3

10. Use cases

To further verify the relevance and utility of the designated ICT sector taxonomy, key use cases are identified as follows (See Figure 7):

- **Category 1:** Applicable to market sizing; immediate comparison is limited due to the high-level definition.
- **Category 2:** Applicable to market sizing, market analysis and regulatory assessments; some categories are comparable based on applied definitions.

- **Category 3:** Applicable to market sizing, market analysis, ICT businesses database and publishing list of active market players, company-level assessments and comparability; comparison is possible due to granular definitions.

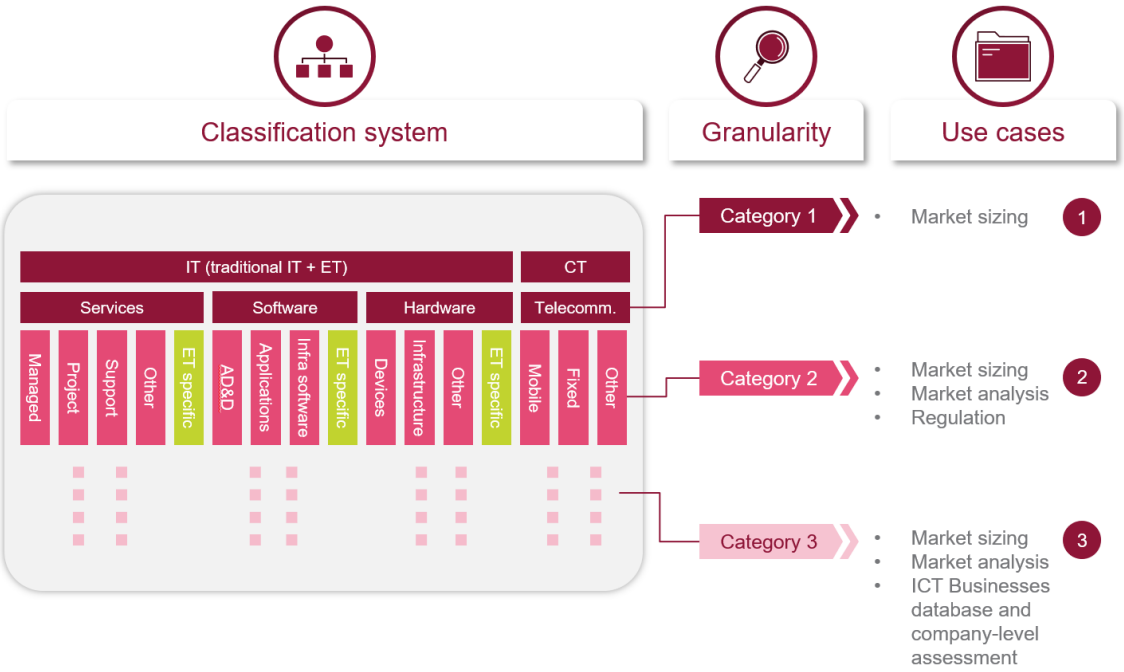

Figure 6: ICT Classification Use Cases Overview

10.1 Market Sizing

Category 1, which is the most aggregated and high-level classification layer, may be used for market sizing-related tasks, for example market sizing and segmentation for Qatar's ICT industry (based on revenues, volumes, numbers of companies, number of employees, etc.).

It should be noted that information captured and analyzed at Category 1 classification level does not necessarily constitute a basis to benchmark Qatar against other countries or other sources given the customized approach to the ICT Classification. One should always test the comparability of various classification categories across sources before conducting any comparative analysis. Comparability must be tested beforehand by analyzing the exact definition and measurability of a specific category.

10.2 Market Analysis and Regulatory Assessments

At Category 2 level the ICT Classification may serve the goal of understanding the market from a qualitative perspective (e.g., especially for analyzing the results and drawing insights from the annual ICT Sector Survey). This level of classification also enables further market analysis and regulatory assessments for targeted initiatives for the ICT sector.

Potential outcome of this use case could be also a market attractiveness analysis per segment (e.g., per Category 2) in terms of growth, maturity, export capabilities, innovation, competitiveness. Another objective of the ICT classification is to provide a sector-specific taxonomy framework for regulatory assessments and further targeted market segmentation and analysis on Category 2 level segments based on the nature of its business.

10.3 ICT Businesses Database and Company-level Assessment

The most granular Category 3 level of the Classification could serve to populate the ICT businesses directory and building a published list of ICT companies active in Qatar, which is a CRA initiative. The expected use in this case refers to:

- Maintaining up-to-date records on active ICT businesses in Qatar and publish the data
- Identify ICT activities on a company level
- Provide detailed measurements on the ICT supply maturity and sophistication at company level/ of the ICT sector overall, both static and over time.

11. Appendix

11.1 ISIC rev.4 definition for ICT sector

The International Standard Industrial Classification of All Economic Activities (ISIC)[8] is the international reference classification of productive activities. It also specifies ISIC codes related to

[8] UN, DESA Statistics Division, ISIC rev.4, https://unstats.un.org/unsd/classifications/Econ/isic

ICT activities, across the value chain, from manufacturing and trade to services. (See Table 9 below).

ICT sector	
ICT manufacturing industries	
2610	Manufacture of electronic components and boards
2620	Manufacture of computers and peripheral equipment
2630	Manufacture of communication equipment
2640	Manufacture of consumer electronics
2680	Manufacture of magnetic and optical media
ICT trade industries	
4651	Wholesale of computers, computer peripheral equipment and software
4652	Wholesale of electronic and telecommunications equipment and parts
ICT services Industries	
5820	Software publishing
61	**Telecommunications**
6110	Wired telecommunications activities
6120	Wireless telecommunications activities
6130	Satellite telecommunications activities
6190	Other telecommunications activities
62	**Computer programming, consultancy and related activities**
6201	Computer programming activities
6202	Computer consultancy and computer facilities management activities
6209	Other information technology and computer service activities
631	**Data processing, hosting and related activities; web portals**
6311	Data processing, hosting, and related activities
6312	Web portals
951	**Repair of computers and communications equipment**

9511	Repair of computers and peripheral equipment
9512	Repair of communications equipment

Table 9: ISIC rev.4 ICT Sector Breakdown
Source: UN, DESA Statistics Division, ISIC rev.4

Further to that, ISIC contains stand-alone Section J Information and Communication, which includes the production and distribution of information and cultural products, the provision of the means to transmit or distribute these products, as well as data or communications, information technology activities and the processing of data and other information service activities (See Table 10). This section has served a guideline on how ICT related business activities should be defined. It is leveraged as a major reference for the development of this ICT classification, with a marginal difference: retailers of ICT products are included as a part of ICT market in the document, not only just wholesalers.

11.2 ISIC rev.4 Classification of Section J, Information and Communication

11 Division	Group	Class	Description
Division 58			**Publishing activities**
	581		Publishing books, periodicals, and other publishing activities
		5811	Book publishing
		5812	Publishing directories and mailing lists
		5813	Publishing newspapers, journals, and periodicals
		5819	Other publishing activities
	582	5820	Software publishing
Division 59			**Motion picture, video, and television program production, sound recordings, and music publishing activities**
	591		Motion picture, video, and television program activities
		5911	Motion picture, video, and television program production activities
		5912	Motion picture, video, and television program post-production activities

		5913	Motion picture, video, and television program distribution activities
		5914	Motion picture projection activities
	592	5920	Sound recording and music publishing activities
Division 60			**Programming and broadcasting activities**
	601	6010	Radio broadcasting
	602	6020	Television programming and broadcasting activities
Division 61			**Telecommunications**
	611	6110	Wired telecommunications activities
	612	6120	Wireless telecommunications activities
	613	6130	Satellite telecommunications activities
	619	6190	Other telecommunications activities
Division 62			**Computer programming, consultancy and related activities**
		6201	Computer programming activities
		6202	Computer consultancy and computer facilities management activities
		6209	Other information technology and computer service activities
Division 63			**Information service activities**
	631		Data processing, hosting, and related activities; web portals
		6311	Data processing, hosting, and related activities
		6312	Web portals
	639		Other information service activities
		6391	News agency activities
		6399	Other information service activities n.e.c.

Table 10: ISIC rev.4 Classification of Section J
Source: UN DESA Statistics Division, ISIC rev.4

11.3. Comparison against KSA CST Classification

	KSA CST Classification	CRA ICT classification
Pros	• Simple and easy to understand since there are only two levels of categories • Well-reflecting strategic focus of KSA IT/ET sector, by making "as a service" and Emerging Technologies as a standalone Level 1 category	• More exclusive three level of categories, thanks to the "canvas" concept as well as a value chain layer • Better mapped different value chain activities of market players to enhance market understanding • Very detailed, considering several levels of categories, a value chain layer and technology stacks
Cons	• Not exclusive from each other under classification categories, e.g., Artificial Intelligence under Emerging Technologies can be also associated with Business Software under Software • Not clear in terms of how different value chain activities will be understood under the classification • Not very detailed, due to a simple structure • Not exhaustive, especially regarding Emerging Technologies	• More sophisticated structure requires detailed understanding for analysis, since there are 3 levels of categories and a value chain layer • Non-explicit strategic focus in the classification system, since it prioritizes exhaustiveness and exclusiveness of the structure, rather than making certain technologies more visible

Table 11: Comparison against KSA Classification
Source: KSA Communications, Space & Technology Commission, Information Technology and Emerging Technologies (IT/ET) Sector Classification