Communications Regulatory Authority
State of Qatar

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دولة قطر

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Information and Communications Technology (ICT) Sector Taxonomy document (ICT sector classification)

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1. Executive summary

The CRA 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.

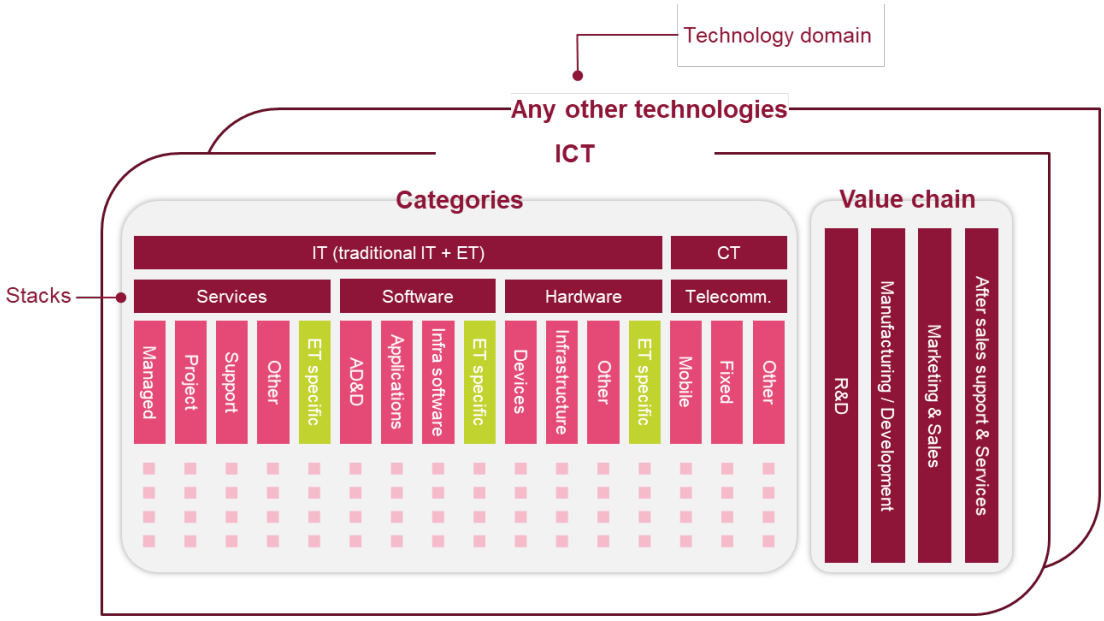
The domains considered under the so called "technology umbrella" of the classification include:

1) Information Technology (IT)
    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 underdevelopment, 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)
    - Technologies related to offering services which provide access to voice, internet, and data services through telecommunications networks and inclusive of all telecommunications standards
    - 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.

Operating Technologies (OT) were not considered in the classification. OT refer to technologies which are used in industrial setups and environments. OT is outside the scope of CRA as per the CRA Strategy 2020-2024 document. If a future strategy revision encompasses OT, it is recommended to add OT as an additional layer.

The suggested 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 structure, including the classification of *categories* and the classification across the *value chain*.



Overview of ICT classification structure

The classification is designed to be inclusive and as activity-based and companies can be (and typically are) active across several aspects of the classification (multiple categories and sub-categories, as well as value chain aspects). 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 can and will 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 to 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 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 classification for Qatar's ICT sector ("Classification") by analyzing various international methodologies and tailoring a best-of-breed approach to the local Qatari context and CRA purposes. The 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 the launch of an online registration platform for Qatar's IT companies. The platform will make available a published list of the active local IT businesses with their business activities categorized as per this sector classification.

3. Objectives

The 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 individual industry players and registered enterprises.
2) Establish a national framework to better understand Qatar's ICT market, to open and structure a communication channel between market players, 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, the Classification has been detailed as per the following structure:

a. Clarity on ICT definition of the CRA Strategy 2020-2024 document
b. Approach and methodology of classification, including further references and best practice, guiding principles and applied criteria
c. Detailed description of new classification in terms of structure, overview and definitions
d. Linkage to other classifications, e.g., ISIC codes, illustrative use cases

4. Scope

The domains considered under the so called “technology umbrella” in the Classification are described below:

1) Information Technology (IT)

IT includes both traditional information technology and Emerging Technology (“**ET**”)[1]. The term Emerging Technology is widely adapted and understood as a reference to technology that has a development and/or application that is figuratively emerging into prominence; the term helps to differentiate towards "established" technologies. Traditional IT and ET can be structured 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 are identified and shortlisted based on secondary research and expert guidance to identify technology areas that (a) have a potential strong future impact 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)

[1] In this document, Emerging Technology includes only fundamental technologies, no technology concepts, such as digital twins or metaverse

Each of the beforementioned seven key 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 system and networks.

The Classification includes wider scope of emerging technologies compared to the CRA Strategy 2020-2024 does, incorporating additional relevant technologies and thus leading to a more holistic scope (see figure 1).

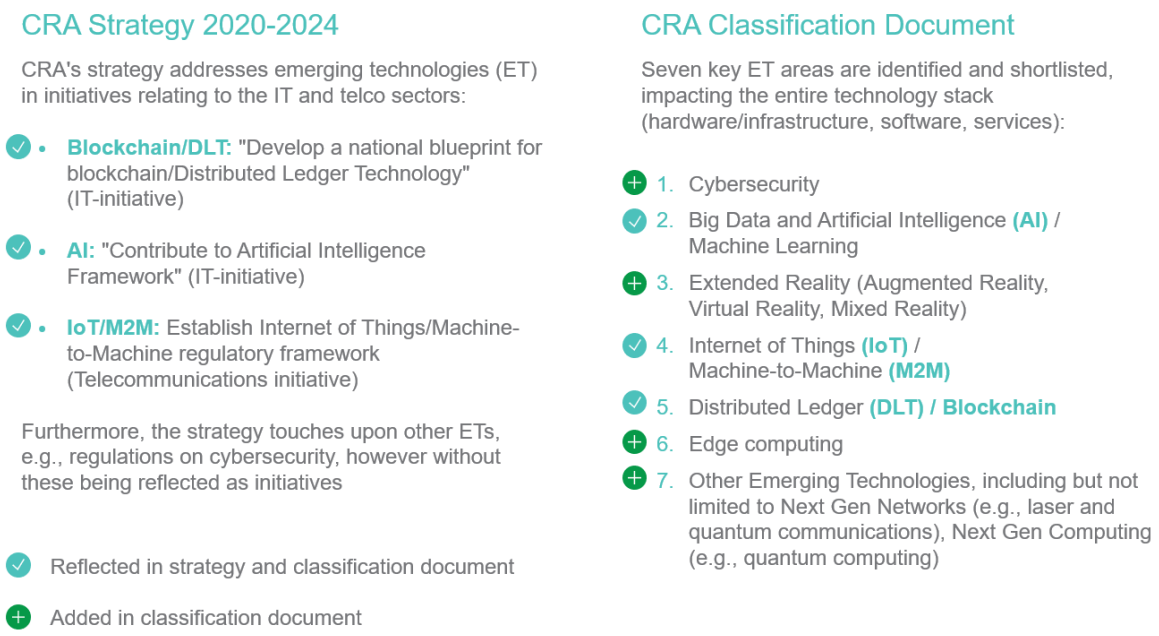


Figure 1: Comparison of ET list of CRA Strategy 2020-2024 and CRA Classification Document

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., to 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 sector classification

3) Operating Technologies (OT)

OT refer 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 2020-2024 document and therefore removed from the classification. However, if a future strategy revision encompasses OT, it is recommended to add OT as an additional layer.

For the above-mentioned research purposes and following 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 Technology, and Communications Technology sectors ("**CT**").

5. Background

The starting point for defining and shortlisting the business activities to be included in the ICT sector classification is CRA's mandate as a regulator of the ICT sector and the sector definition as provided by the CRA Strategy 2020-2024[2].

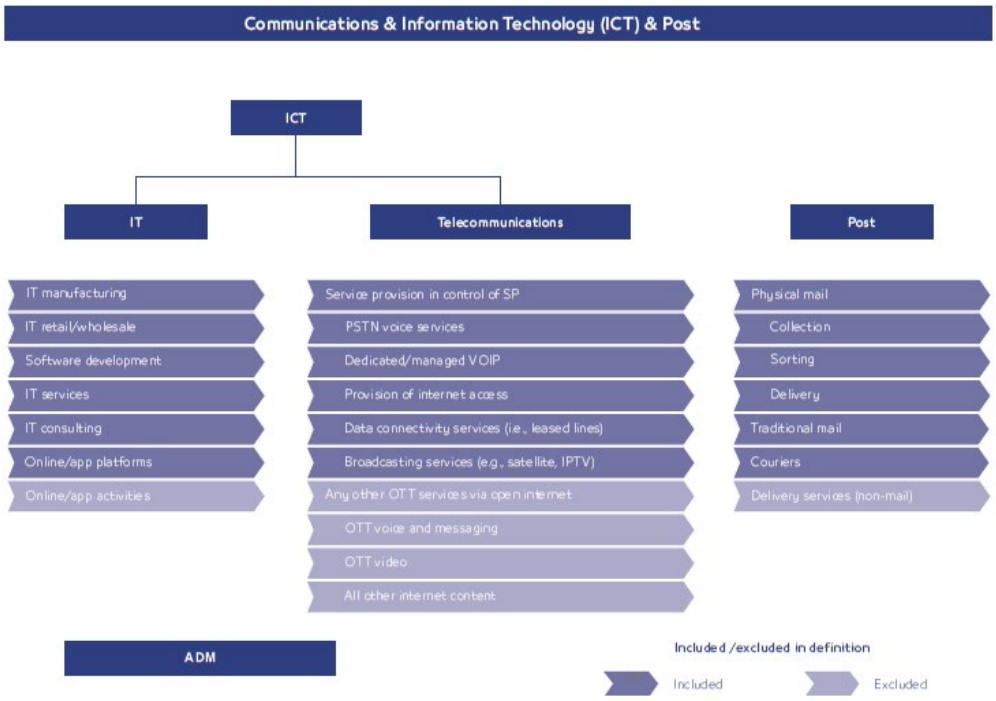


Figure 2: CRA Strategy 2020-2024 ICT sector definition

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 includes provision of internet access, data connectivity services, among others (see figure 2). As mentioned communications technology (CT) and telecommunications are used interchangeably.

The CRA Strategy 2020-2024 recommends to further detail its classification. This document addresses the strategy's recommendation, as it goes beyond the level of comprehensiveness and detail of the CRA Strategy 2020-2024 and structures the sector into multiple, more detailed

[2] Source: CRA Strategy 2020-2024

levels of sector categories; furthermore, an additional layer of detailing is introduced across the ICT *value chain*.

6. Methodology and Approach

This chapter explains how the classification is developed.

- The first section highlights the current limitations that drive the need for a new classification.
- The following two sections describe the key principles and general approach for setting up the suggested classification system.

The ICT sector classification detailed in this document is a draft developed as part of the research framework design for the ICT Survey. The draft classification will be tested through the CRA ICT Survey (to be conducted between March and June 2022) and its overall structure and logic will hence be refined (if needed) by incorporating (a) feedback from the respondents and (b) the analysis of their responses and of their ability to classify their business activities.

6.1 Initial situation

The need for a new industry classification system 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 databases[3] available in Qatar and relevant to the ICT sector apply non-sector specific categories and are based 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. There is a dedicated section for "Information and Communication" (see appendix), which also includes media-related activities, such as publishing and content 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.

[3] PSA national accounts, MOCI business registrations, CRA ICT sector reports and measurements

Hence, using the ISIC Information and Communication Group as a classification structure is not suitable.

Alternatively, another ISIC directory can be referred to the ICT sector, called an “alternative aggregation ICT sector table” (see 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.

To overcome the limitations of the ISIC classification — not allowing relevant sector segmentation and depth, measurements, or analysis — a new classification system must be defined. This new classification should be able to overcome the existing limitations of the ISIC coding system, as well as serve the purposes and expected use cases of CRA as an ICT regulator and other sector players more generally.

6.2 Key principles

The recommended ICT sector classification reflects the CRA mandate and purpose, and is based on the following guiding principles:

1) Comprehensiveness. Ensure the classification covers all main and subsidiary business activities and services of the ICT sector.
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] Source: ISIC revision 4, United Nations, Statistics Division (2008),
Link: https://unstats.un.org/unsd/publication/seriesm/seriesm_4rev4e.pdf

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 Classification follows a balanced approach across five dimensions of considerations. Thus, the classification 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

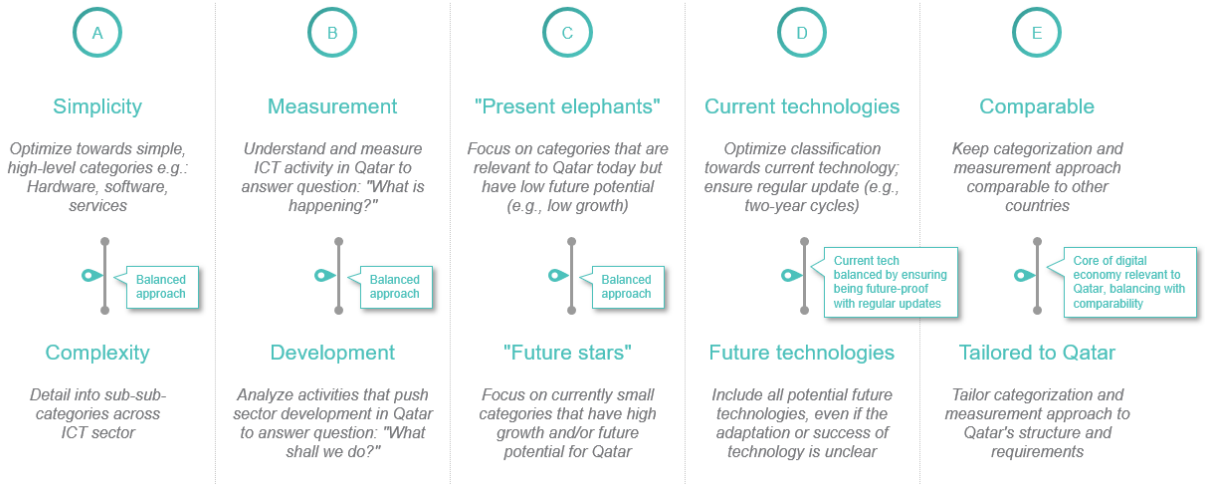


Figure 3: Overview of balancing factors taken into account for classification

6.3 Classification Development approach

To gain a better understanding, various ICT classification references have been listed based on 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
- IDC Worldwide Black Book Taxonomy
- OECD taxonomy and definition of ICT sector

The above classification references have been shortlisted based on the key principles mentioned in section 5.2 above. These principles can be rephrased 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.
- 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.

[5] Links: https://www.msci.com/our-solutions/indexes/gics; 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

Assuming that each criterion is equally important, the following three references are shortlisted (see figure 4):

1) International Standard Industrial Classification (ISIC)

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

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

   Since KSA is a regional peer, its sector performance and governance present many comparable characteristics, with direct implications on the sector classification (albeit more tailored to IT than ICT). Released in March 2021, the Saudi 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 classification is future-oriented and reflects on various new market trends. Furthermore, the classification 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 a possibility of leveraging IDC research data for market sizing and benchmarking purposes.

   (Note: IDC market data for Qatar is not available at the moment, only benchmark and regional analyses are possible, which limits the available data but emphasizes the importance and opportunity of this document's classification for Qatar.)

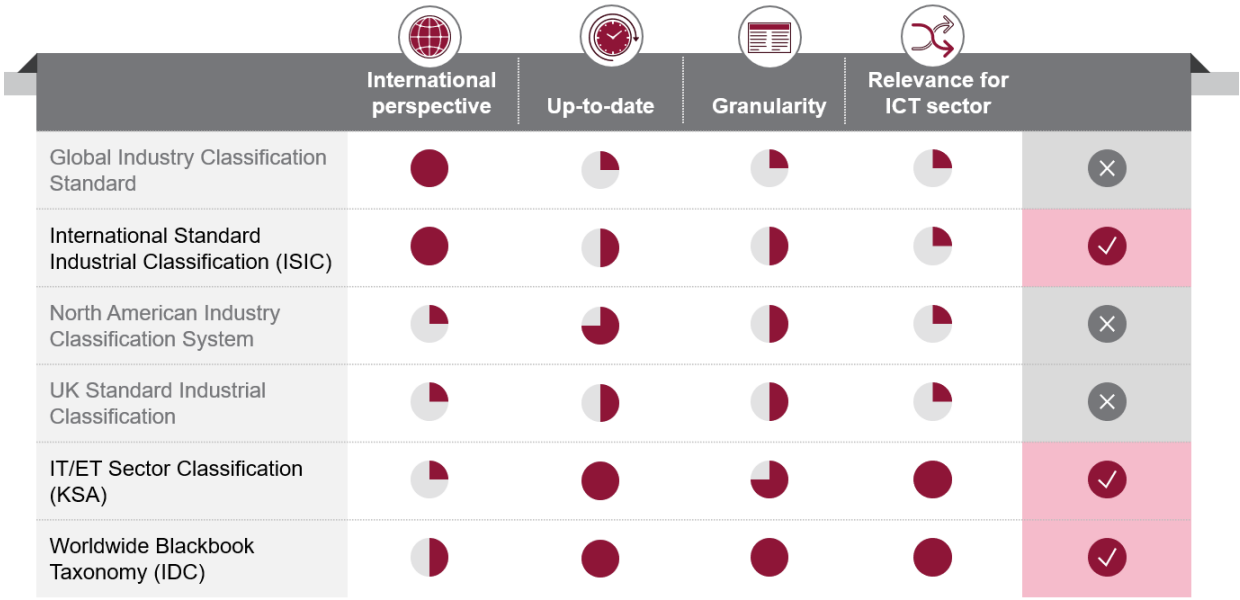


Figure 4: Shortlisted ICT Classification references

Guided by the key principles detailed in section 5.2, our approach builds on these shortlisted referenced classifications to incorporate best practices and tailor them to the needs to the local market, ensures emerging technologies are effectively reflected to future-proof the 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.

In the future, the referenced classifications will undergo updates and revisions; the classification system in this document will be subject to periodic reviews by the CRA, which may take revisions of the referenced classifications into account. In addition, the classification may be further assessed in line with the latest developments in the ICT products and services sector and, as such, updated accordingly.

7. Classification Overview

7.1 Introduction

The suggested 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. 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 classification structure is visualized in the following chart (see figure 5). It is designed as flexible and future-proof since 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 chains, 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 classification is designed to be inclusive and as activity-based and companies can be (and typically are) active across several aspects of the classification (multiple categories and sub-categories, as well as value chain aspects). 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 can and will change. For example, trends show telco companies are increasingly developing into multiple IT-related activities and into the IT sector in general.

Throughout the document, "classification" refers to the total structure, including the classification of *categories* and the classification across the *value chain*.

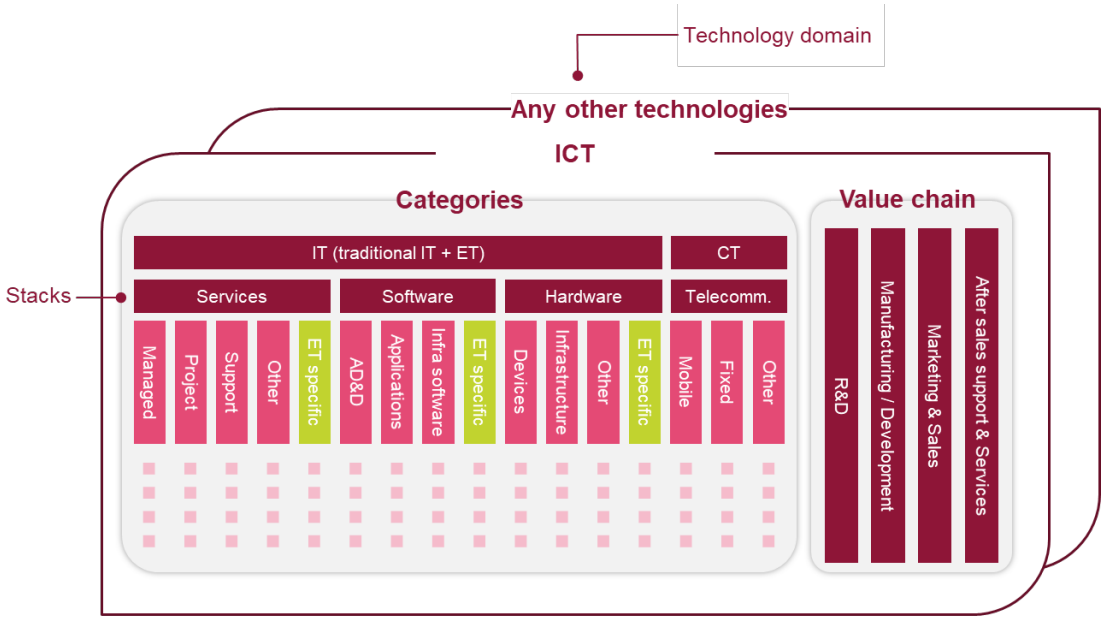


Figure 5: Overview of ICT classification structure

7.2 Category 1 overview

Category 1 (see table 1) consists of three main segments for Information Technology ("IT") and one segment for Communications Technology ("CT"). One thing to note is that "Services" as a level 1 category is different from "After sales support and service" element from the value chain layer. "Services" as category 1 component refers to a business activity related to pure provision of knowledge or expertise.

	Category 1	Clarification
IT[6] & 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

[6] IT covers traditional Information Technology (Traditional IT)

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: Category 1 classification
Source: Internal analysis

The overview of the Classification structure highlights that "services" can be seen both from a category perspective as well as from a value chain perspective. For the sake of clarity, the category "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 Category 2 and category 3 overview

Category 2 consists of 15 segments and category 3 consists of 60 sub-segments (see table 2), with an additional layer for to reflect on the value chain activities. Further details 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 Technology (ET) specific services	Cybersecurity services				
		Big Data and Artificial Intelligence / Machine Learning services				

Category 1	Category 2	Category 3	Value chain			
			R&D	Manufact. / Develop.	Sales	After sales support & service
		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 Technology 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				
		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				

Category 1	Category 2	Category 3	Value chain			
			R&D	Manufact. / Develop.	Sales	After sales support & service
		Physical and virtual computing software				
		Storage software				
		System and service management software				
		Other traditional IT infrastructure software				
	Emerging technology (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				
		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 technology (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				

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

Table 2: Category 2 and 3 classifications with value chain activities layer
Source: IDC, internal analysis

8. Definitions of Classification Categories and Value Chain Activities

The following tables provide definitions for the four main categories (services, software, hardware, and telecommunications services) by detailing them on category levels 2 and 3.

8.1 IT: Services

The below table 3 provides the definitions for the business activities under Information Technology Services (category 1), across five level 2 categories and fourteen level 3 categories.

Category 1: 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)

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

Category 1: Services			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition[7]**
Other traditional IT services	Other traditional IT services	**Other**	- Other traditional IT related services
Emerging Technology (ET) specific services	Services related to the seven Emerging Technology (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 services**	- Services for protecting networks, devices, and data from unauthorized access or criminal use - Services for ensuring confidentiality, integrity, and availability of information
		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 Technology (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: Services classification and definition
Source: IDC, Internal analysis

8.2 IT: Software (including Platforms)

The below table 4 provides definitions for business activities under Information Technology Software (category 1), across four level 2 categories and more than twenty level 3 categories.

Category 1: 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: 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
		Supply chain management (SCM) applications	- Inventory management applications - Logistics applications - Production planning applications
		Other	- Other traditional IT related applications

Category 1: Software (including Platforms)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
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 Technology (ET) specific Platforms and Software	Platforms and software related to the seven Emerging Technology (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 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
		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

Category 1: Software (including Platforms)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
		Other Emerging Technology (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: Software classification and definition
Source: IDC, Internal analysis

8.3 IT: Hardware (including Infrastructure)

The below table 5 provides definitions for business activities under Information Technology Hardware (category 1), across four level 2 categories, and thirteen level 3 categories.

Category 1: 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
		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)

Category 1: Hardware (including Infrastructure)			
Category 2	**Category 2 Definition**	**Category 3**	**Category 3 Definition**
Emerging Technology (ET) specific Hardware and Infrastructure	Hardware and Infrastructure related to the seven Emerging Technology (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
		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: Hardware classification and definition
Source: IDC, internal analysis

8.4 CT: Telecommunications Services

The below table 6 provides definitions for business activities under Communications Technology, across three level 2 categories and five level 3 categories.

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) - 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: Telecommunications Services classification and definition
Source: IDC, internal analysis

8.5 Value chain activities

The below table 7 provides clarifying examples for each value chain activity that is added as an additional layer on the 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 presence in the local market. Accordingly, this may allow targeted regulatory interventions in the future.

Domain	Value chain	Clarifying examples
Traditional Information Technology (IT) and Emerging Technology (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)
	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: Value chain activities definition
Source: internal analysis

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
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 Technology (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 Technology specific services	6201, 6202, 6209, 9511, 9512
		Analytics and business intelligence	5820, 4651, 6311

Category 1	Category 2	Category 3	Relevant ISIC
Software (including Platforms)	Traditional IT application development and deployment	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
		Storage software	5820, 4651, 6311
		System and service management software	5820, 4651, 6311
		Other traditional IT infrastructure software	5820, 4651, 6311
	Emerging Technology (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

Category 1	Category 2	Category 3	Relevant ISIC
		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
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 Technology (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
		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
Source: internal analysis

10. Use cases

To further verify the relevance and utility of the designated classification, key use cases are identified (see figure 6).

- **Category 1:** Applicable to market sizing; immediate comparison is limited due to high-level definition
- **Category 2:** Applicable to market sizing, market analysis and regulation; some categories are comparable
- **Category 3:** Applicable to market sizing, market analysis, company registration ***and comparability***; comparison is possible due to granular definition

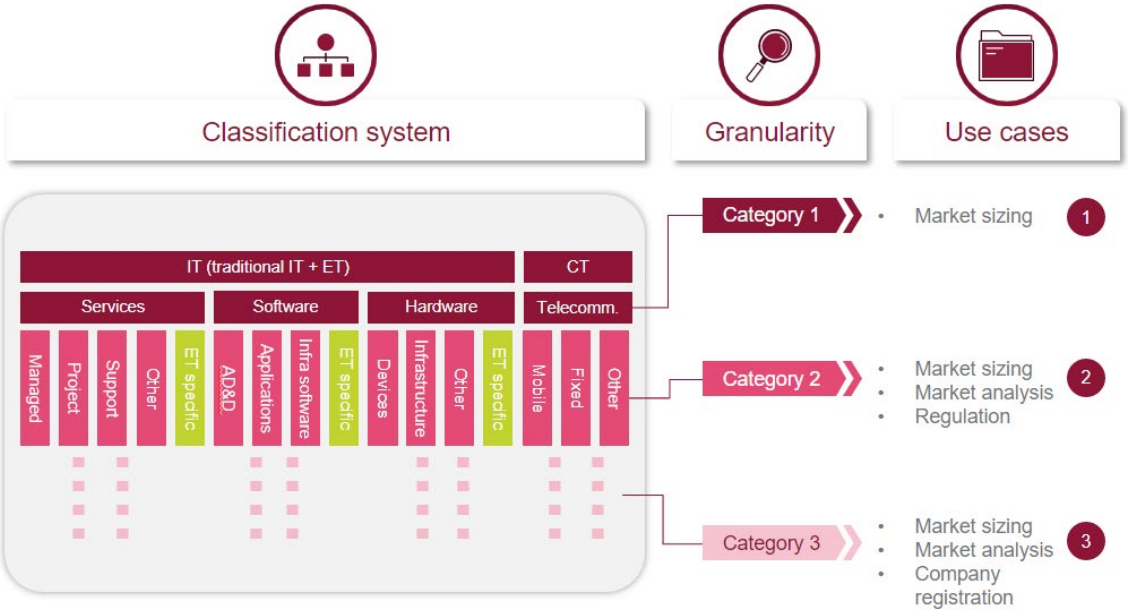


Figure 6: Classification use cases overview

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 sector (revenues / volumes / numbers of companies / number of employees),

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 uniqueness of the classification. One should always test the comparability of

classifications across countries 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 regulation

Category 2 serves the primary 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 setting up a relevant regulatory framework and specifying target initiatives for the sector.

The expected outcome of market analysis use cases is a market attractiveness analysis per segment (e.g., per category 2) in terms of growth, maturity, export capabilities, innovation, competitiveness. The main sources will be:

- ICT spending or demand-related data[8]
- Outcome of use case 1 (market sizing)
- Survey results (standard / in-depth)

A fundamental objective of the classification is to provide a market structure framework for regulatory assessments and further targeted market analysis. In other words, this use case will help develop a structure for each segment (e.g., each category 2) based on the nature of its business. The use case will be based on three main sources:

- Secondary research
- Benchmark analysis against comparable countries in ME
- Survey results (standard/in-depth)

10.3 IT businesses registration and database

The most granular category 3 level of the classification might serve the prospective IT businesses registration purposes and the online IT companies' platform, as a planned CRA initiative. The expected outcomes in this case:

- List the business activities on a company level for each IT business active in Qatar and publish data via an online registration platform;

[8] e.g., IDC Worldwide ICT spending

- Identify primary and secondary activities on a company level;
- Provide detailed measurements on the maturity and sophistication on a company level/ of the ICT sector overall, both static and over time.

Two main sources serve the registration of ICT companies and sector database use case:

- ICT survey findings to readjust the classification system
- Existing company information databases, e.g., MOCI, QFC

11. Appendix

11.1 Classification structure in detail

Excel file provided.

11.2 ISIC rev.4 definition for ICT sector

The International Standard Industrial Classification (ISIC) of All Economic Activities rev. 4 defines ICT as "production of an industry that fulfills or enables the function of information processing and communications by electronic means.[9]" It also specifies ICT sector related ISIC codes (see table below), which encompass various value chain activities, from manufacturing and trade to services.

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

[9] Source: United Nations

6312	Web portals
951	**Repair of computers and communications equipment**
9511	Repair of computers and peripheral equipment
9512	Repair of communications equipment

Table 10: ISIC rev.4 ICT sector breakdown
Source: UN

This table gives a guideline on how ICT sector related business activities should be defined. It is leveraged as a major reference for the development of this document's classification, with a marginal difference: retailers of ICT products are included as a part of ICT market in the document, not only just wholesalers.

11.3 ISIC rev.4 Classification of Section J, Information and Communication[10]

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**

[10] Source: UN

	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 11: ISIC rev.4 Classification of Section J
Source: UN

11.4 Comparison against KSA Classification

	KSA CITC Classification	Developed classification for CRA
Pros	• Simple and easy to understand since there are only 2 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 level 3 categories, thanks to the "canvas" concept as well as a value chain layer • Better mapped different value chain activities of market players, which will 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 in 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 12: Comparison against KSA Classification
Source: KSA CITC Classification