NATIONAL COMPETENCY STANDARDS
FOR
BLOCKCHAIN TECHNOLOGIST
(DIPLOMA)

ICT SECTOR

TECHNICAL & VOCATIONAL EDUCATION AND TRAINING QUALITY COUNCIL
BHUTAN QUALIFICATIONS AND PROFESSIONALS CERTIFICATION AUTHORITY
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FOREWORD

The TVET Quality Council, BQPCA, is pleased to present the National Competency Standards (NCS) for Blockchain Technologist, Diploma, developed in collaboration with industry experts and trainers. These standards establish a nationally recognized qualification aligned with international best practices, setting a benchmark for TVET qualifications in Bhutan.

The NCS ensures that trainees acquire the necessary skills, knowledge, and attitude required by industries. Developed through close consultation with experts, it enhances the relevance of training to labor market needs, equipping graduates to meet industry expectations and improving their employability. A strong and responsive TVET system will also make vocational education more attractive to youth.

The Council acknowledges the valuable contributions of industry experts and trainers in the development of these standards. We urge employers and training providers to continue their support in implementing the NCS, fostering a skilled and productive workforce that contributes to national socio-economic development. Moving forward, we look forward to enhanced industry engagement and collaborative efforts in building a quality-assured, demand-driven TVET system.

Director
BQPCA

ACKNOWLEDGEMENT

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The TVET Quality Council, Bhutan Qualifications and Professionals Certification Authority would like to express our deepest appreciation to the following industry and subject matter experts who have participated in development of the National Competency Standards:

Experts involved in development of the NCS			
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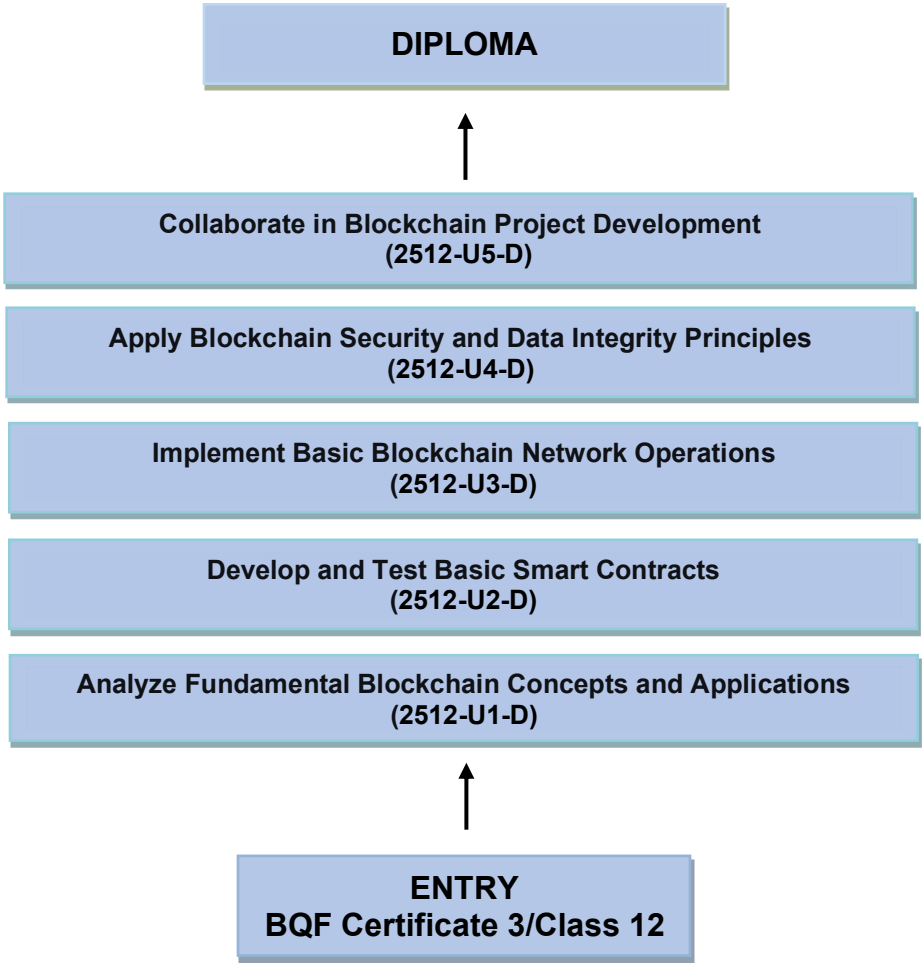
PACKAGING OF QUALIFICATIONS



Overview of the NCS

Unit Title	Elements of Competence
1. Analyze Fundamental Blockchain Concepts and Applications	1. Explain fundamentals of blockchain technology 2. Identify industry use-cases for blockchain solutions 3. Compare major blockchain platforms and protocols
2. Develop and Test Basic Smart Contracts	1. Set up a development environment for Blockchain 2. Write secure, functional smart contracts 3. Deploy and interact with smart contracts 4. Conduct testing and debugging
3. Implement Basic Blockchain Network Operations	1. Participate in a blockchain network 2. Interact with blockchain data 3. Utilize basic decentralized application (dApp) components
4. Apply Blockchain Security and Data Integrity Principles	1. Implement cryptographic fundamentals 2. Adhere to security best practices 3. Ensure data source and integrity
5. Collaborate in Blockchain Project Development	1. Work within a blockchain development lifecycle 2. Communicate technical concepts effectively 3. Adhere to legal, regulatory, and ethical guidelines

UNIT TITLE	Analyze Fundamental Blockchain Concepts and Applications
DESCRIPTOR	This unit covers the fundamental principles of blockchain, including how it works, different types of chains, consensus mechanisms, and when to use blockchain to solve real-world business problems.
CODE	2512-U1-D
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Explain fundamentals of blockchain technology	1.1 Define key terminology including distributed ledger, decentralization, consensus, immutability, smart contract and cryptography ***1.2*** Distinguish between different ***types of blockchains*** 1.3 Describe the structure of a block and its linkage in a chain using cryptographic hashes. 1.4 Explain the role of digital signatures and public-key cryptography in transaction authentication.
2. Identify industry use-cases for blockchain solutions	2.1 Categorize potential applications across sectors such as finance, supply chain, identity, and healthcare. 2.2 Differentiate between problems suitable for blockchain and those that are not.

	2.3 Analyze a simple business case to identify potential benefits and limitations of a blockchain approach. 2.4 Describe common ***blockchain patterns***
3. Compare major blockchain platforms and protocols	3.1 Outline the key features and typical use cases of at least two major platforms (e.g., Ethereum, Hyperledger Fabric). 3.2 Differentiate among ***various consensus mechanisms.*** 3.3 Compare ***transactional characteristics*** of selected platforms. 3.4 Identify the native cryptocurrency/token associated with a given public blockchain.

RANGE STATEMENT	
Types of Blockchains may include but not limited to:	
• Public • Consortium,	• Private • Hybrid
Blockchain patterns may include but not limited to:	
• Asset provenance	• Smart contracts for automation
Various consensus mechanisms may include but not limited to:	

• proof-of-work and • proof of authority	• proof-of-stake • proof of space and time
Ttransactional characteristics may include but not limited to:	
• *speed* • *finality*	• *cost*
Critical Aspects	
• Follow Safety at workplace • Follow standard procedure for all the tasks • Define Blockchain	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid • Blockchain basics: decentralized, secure ledger • Hashing & digital signatures • Public vs private chains • How consensus works (PoW, PoS) • Good vs bad use cases	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Time Management • Innovation

• Major platforms (Ethereum, Hyperledger) • Concept on Decentralized storage (IPFS) • Tokenizations	

UNIT TITLE	Develop and Test Basic Smart Contracts
DESCRIPTOR	This unit covers writing basic smart contracts, setting up development tools, deploying to test networks, and testing contract functions for security and accuracy.
CODE	2512-U2-D
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Set up a development environment for Blockchain	1.1 Install and configure ***necessary software*** tools 1.2 Connect the development environment to a blockchain test network or local simulation. 1.3 Create a basic project structure for smart contract development. 1.4 Utilize a code editor with appropriate extensions for syntax highlighting and error checking. 1.5 Basic use of containerization tools (Docker)
2. Write secure, functional smart contracts	2.1 Implement a basic smart contract in Solidity (or platform-specific language) with variables, functions, and events. 2.2 Apply standard security practices to mitigate ***common vulnerabilities*** 2.3 Incorporate access control mechanisms (e.g., owner-only functions) within the contract.

	2.4 Ensure code follows style guides and includes clear commenting for maintainability.
3. Deploy and interact with smart contracts	3.1 Compile a smart contract without errors. 3.2 Deploy a contract to a designated test network using appropriate tools and commands. 3.3 Verify successful deployment by obtaining and recording the contract address and ABI. 3.4 Execute contract functions through a web interface or script to test core functionality.
4. Conduct testing and debugging	4.1 Write and run basic tests for smart contracts using a testing framework. 4.2 Simulate various user interactions and edge cases to validate contract logic. 4.3 Interpret transaction receipts and event logs to debug issues. 4.4 Utilize blockchain explorers to monitor and verify on-chain contract activity.

RANGE STATEMENT	
Necessary software may include but not limited to:	
• Node.js • Hardhat	• Truffle Suite • Remix IDE

common vulnerabilities may include but not limited to:	
• reentrancy	• integer overflow
Critical Aspects	
• Follow Safety at workplace • Follow standard procedure for all the tasks • Write secure smart contract	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid • NFT trading (Open Sea) • About smart contracts • Basic Solidity/other relevant blockchain compatible languages • Build-test-deploy process • Common security risks • Testing methods • Deployment steps	• Team Work • Communication • Problem Solving • Interpersonal Relationship • Time Management • Innovation

UNIT TITLE	Implement Basic Blockchain Network Operations
DESCRIPTOR	This unit covers managing wallets, sending transactions, using block explorers, and connecting front-end applications to blockchain networks.
CODE	2512-U3-D
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Participate in a blockchain network	1.1 Set up and secure a digital wallet for managing cryptographic keys and assets. 1.2 Perform basic wallet operations: sending, receiving, and tracking transactions. 1.3 Explain the process of transaction creation, signing, broadcasting, and confirmation. 1.4 Calculate and pay appropriate transaction fees (gas) for public blockchain.
2. Interact with blockchain data	2.1 Use a blockchain explorer to look up blocks, transactions, addresses, and smart contracts. 2.2 Extract and interpret key data from a block header and its contents. 2.3 Query a blockchain node (e.g., via JSON-RPC) for basic network information. 2.4 Explain the concept of mempool and its role in transaction processing.

3. Utilize basic decentralized application (dApp) components	3.1 Integrate a web front-end with a user's wallet (e.g., MetaMask) for authentication. 3.2 Connect a front-end interface to a deployed smart contract using a web3 library. 3.3 Display ***basic blockchain data*** on a user interface. 3.4 Enable a user to trigger a simple, signed transaction from a web interface.

RANGE STATEMENT	
Basic blockchain data may include but not limited to:	
• account balance,	• contract state
Critical Aspects	
• Follow Safety at workplace • Follow standard procedure for all the tasks • Setting up and secure digital wallet	

UNDERPINNING KNOWLEDGE	UNDERPINNING SKILLS
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid	• Team Work • Communication • Problem Solving

• Wallet/key safety • Transaction parts & flow • Connecting to blockchain (APIs) • dApp components • Using block explorers • Gas/fees basics	• Interpersonal Relationship • Time Management • Innovation

UNIT TITLE	Apply Blockchain Security and Data Integrity Principles
DESCRIPTOR	This unit covers how hashing and digital signatures protect data, best practices for key security, and verifying information on the blockchain.
CODE	2512-U4-D
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Implement cryptographic fundamentals	1.1 Generate and manage cryptographic key pairs securely. 1.2 Demonstrate the process of creating a cryptographic hash of a given data input. 1.3 Illustrate how a Merkle Tree validates data integrity within a block. 1.4 Explain the role of hashing in creating the immutable chain of blocks.
2. Adhere to security best practices	2.1 Follow secure procedures for key and seed phrase storage and backup(wallet). 2.2 Identify and avoid common phishing and social engineering threats in the blockchain context. 2.3 Apply the principle of least privilege in configuring contract and system access. 2.4 Conduct basic code analysis to recognize obvious security threats.

3. Ensure data source and integrity	3.1 Design a simple data model for recording an asset's lifecycle on a blockchain. 3.2 Create transactions that immutably log steps in a supply chain or process. 3.3 Verify the authenticity and unchanged state of a datum by tracing its hash to a block header. 3.4 Explain how non-repudiation is achieved through cryptographic signing.

RANGE STATEMENT
Critical Aspects
• Follow Safety at workplace • Follow standard procedure for all the tasks • Cryptographic mechanism (Private and Public keys/ hashing)

UNDERPINNING KNOWLEDGE	**UNDERPINNING SKILLS**
• Ethics and Integrity • Occupational Health and Safety regulations • Basic first Aid	• Team Work • Communication • Problem Solving

• Drag and drop learning (Eg. ETH BUILD) • Low code - No code • Hashing for data proof • Digital signatures • Common scams • Key protection • On-chain/off-chain verification • Basic regulations	• Interpersonal Relationship • Time Management • Innovation

UNIT TITLE	Collaborate in Blockchain Project Development
DESCRIPTOR	This unit covers working in a team using standard tools, documenting work, communicating with stakeholders, and following legal and ethical guidelines.
CODE	2512-U5-D
ELEMENTS OF COMPETENCE	PERFORMANCE CRITERIA
1. Work within a blockchain development lifecycle	1.1 Contribute to a project plan outlining phases for a simple blockchain-based solution. 1.2 Participate in a collaborative coding environment using version control (e.g., Git). 1.3 Document code and write basic user/technical documentation for a developed component. 1.4 Follow prescribed testing and quality assurance protocols before deployment.
2. Communicate technical concepts effectively	2.1 Explain a developed blockchain solution to a technical peer using appropriate diagrams and terminology. 2.2 Describe the value proposition of a blockchain application to a non-technical stakeholder in simple terms. 2.3 Document a bug or issue clearly with steps to reproduce and expected vs. actual behavior.

	2.4 Present findings from a basic analysis of a blockchain transaction or block.
3. Adhere to legal, regulatory, and ethical guidelines	3.1 Identify key legal and regulatory considerations for blockchain projects in a given jurisdiction (e.g., data privacy). 3.2 Apply ethical principles regarding transparency and fairness in smart contract design. 3.3 Recognize the environmental impact of different consensus mechanisms. 3.4 Follow intellectual property and open-source licensing requirements for used code.

RANGE STATEMENT
Critical Aspects
• Follow Safety at workplace • Follow standard procedure for all the tasks • Git Version Control

UNDERPINNING KNOWLEDGE	**UNDERPINNING SKILLS**
• Ethics and Integrity	• Team Work • Communication

• Occupational Health and Safety regulations • Basic first Aid • Integration with Bhutan NDI • Project life cycle • Team tools (Git) • Documentation • Legal basics • Sustainability	• Problem Solving • Interpersonal Relationship • Time Management • Innovation

ANNEXURE

National Competency Standards (NCS)

The National Competency Standards specify the skill, knowledge and attitudes applied to a particular occupation. Standards also specify the standards or criteria of performance of a competent worker and the various contexts in which work may take place. Standards provide explicit advice to assessors regarding the skill and knowledge to be demonstrated by candidates seeking formal recognition either following training or through work experience.

Purpose of National Competency Standards

National Competency Standards serve a number of purposes including:

- Providing advice to curriculum developers about the competencies to be included in the curriculum.
- Providing specifications to assessment resource developers about the competencies within an occupation to be demonstrated by candidates.
- Providing advice to industry/employers about job functions, which in turn can be used for the development of job descriptions, performance appraisal systems and work flow analysis.

Bhutan Qualifications Framework (BQF)

Bhutan Qualifications Framework is an integrated national framework that outlines all types of qualification in Bhutan. As an established and nationally accepted instrument, the BQF has been benchmarked against international practices in terms of standards. The BQF aims to recognize all forms of learning systems, including formal, non-formal, and informal learning. It acknowledges technological advancements and recognizes contemporary

modes of delivery. It covers a broad range of education systems including the TVET education.

Implementation of TVET Qualifications

*** RPL = Recognition of Prior Learning**

TVET Qualifications Levels

TVET Qualifications have seven levels as per the BQF as follows:

Bhutan Qualifications Framework 2023

Table 2: Qualification Types and Levels Based on Education Sector.

BQF Level	Community Education	School Education	TVET	Higher Education	Monastic Education
8				Doctoral Degree	*Khewang* ཟབ་བསྟན་དཔང་།
7			Master's Degree Postgraduate Diploma Postgraduate Certificate	Master's Degree Postgraduate Diploma Postgraduate Certificate	*Tsugla Gongma* གསུང་ཡིག་གོང་མ།
6			Applied Degree	Bachelor's Degree Bachelor's Degree (Honours) Graduate Diploma Graduate Certificate	*Tsugla Wogma* གསུང་ཡིག་འོག་མ།
5			Advanced Diploma	Advanced Diploma	
4			Diploma	Diploma	
3		Bhutan Higher Secondary Education Certificate	Certificate 3		*Dringrim Gongma* འབྲིང་རིམ་གོང་མ།
2		Bhutan Certificate for Secondary Education	Certificate 2		*Dringrim Barma* འབྲིང་རིམ་བར་མ།
1	ALC		Certificate 1		

Level Descriptors

The TVET Qualification levels are set based on the level descriptors, as defined in the BQF. The detail of the qualification level descriptor is as follow:

Level	Knowledge Knowledge that is:	Skills Demonstrate skills that involve:	Values Demonstrate values that involve:	Application Applied in contexts that involve:
4	Broad theoretical, technical and operational	Selecting and applying a range of standard processes relevant to varied and sometimes unpredictable tasks Selecting and applying a range of solutions involving formulation of solutions to resolve complex issues Demonstrating a high level of proficiency in English and Dzongkha	Strong level of awareness of self and others; and an appreciation of belief system, role of social norms, and the importance of relationship building Application of ethical norms and legal rules in decision-making; and comprehending the correlation between values and behavior Commitment to own profession and quality of work	Stable tasks with predictable changes Broad guidance with some self-direction that requires sound judgement Taking some responsibility for planning and coordination with others
3	Theoretical with some technical and operational processes	Applying a range of standard processes to known but varied tasks Selecting and applying a range of solutions to familiar	Sound level of self-awareness and beliefs; and ability to apply social norms and	Stable tasks with some aspects of change General guidance and supervision

		and unfamiliar problems Communicating effectively and clearly, both oral and written, in both English and Dzongkha	build relationships Application of a set of ethical norms Commitment to own field of interest and apply self-management of learning and performance	that require discretion and judgement Adapting to own behaviour to work with others
2	Basic, factual and conceptual	Applying standard processes relevant to carry out known tasks Applying a set of known solutions to solve simple and straightforward issues Using simple and direct exchange of information on familiar and routine matters Developing basic proficiency in Dzongkha and English	Some level of self-awareness and beliefs, and appreciation of social norms; and significance of relationships Awareness of ethical norms, and openness to different activities Developing own knowledge and skills	Structured and stable tasks General support and Supervision that require some discretion and judgement Collaboration with others to achieve goals
1	Foundational, every day and general	Applying operational literacy, numeracy skills required to carry out simple tasks Applying simple solutions to solve simple and straightforward everyday issues	Basic awareness of self, beliefs, and social norms; and understand the significance of relationships Basic awareness of	Highly structured tasks with close support and supervision Minimal Discretion and judgement

		Communicating using everyday expressions and simple phrases in Dzongkha and English	fundamental ethical norms, basic civil rights, and responsibilities Willingness to understand tasks and motivated to implement them successfully	Readiness to work together and share knowledge with others

CODING USED FOR NATIONAL COMPETENCY STANDARDS

The coding and classification system developed in Bhutan is logical, easy to use, and also aligned with international best practices. The Bhutanese coding and classification system is based on the International Standard Classification of Occupations, 2008 (ISCO-08) developed by the International Labour Organisation (ILO).The coding of the National competency standards forms the basis of the identification code for the Technical & Vocational Education and Training Management Information System (TVET – MIS) both in terms of economic sector identification and that of the individual standard.

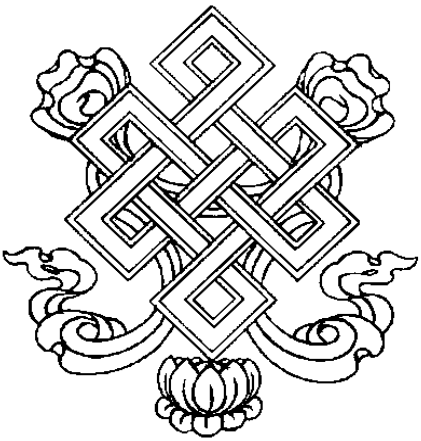
Coding the individual national competency standards

Coding the individual skills standard has a multiple purpose:

- to identify the level,
- to identify to which module the standard belongs,
- to identify in which order the standard is clustered within that module.

A job can include a number of competencies described in the national competency standards.

However, in order to follow a logical order, only national competency standards related to each other and following a logical sequence in terms of training delivery, from the simple to the complex, are clustered into a module. Some standards are so complex that they need to stand alone.



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