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TRUSTFOOD Learning Ecosystem

Work Package 3

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Executive Summary

The present deliverable (D3.2) is destined to encapsulate the essence and overarching goals of the TRUSTFOOD Learning Ecosystem, an ambitious initiative aimed at revolutionizing the agri-food sector through the integration of blockchain technology. At the heart of this transformative agenda is the development of an advanced learning ecosystem designed to enhance the effectiveness of the training process by synergizing theoretical knowledge with practical, interactive learning experiences.

The deliverable comprises several key sections, starting with an Introduction that sets the stage for the ecosystem, followed by the Methodology that outlines the approach taken to develop the learning ecosystem.

A significant part of the deliverable is dedicated to the Design of Educational Courses, presenting a comprehensive suite of 20 short courses. These courses cover a broad spectrum of topics, ranging from foundational knowledge on blockchain technology and digital assets to specialized applications within the food supply chain, such as traceability, smart contracts, and tokenization. Each course is designed to cater to a diverse set of learning objectives and styles, incorporating a variety of interactive elements like quizzes and videos to ensure a rich and engaging learning experience.

The courses touch upon specific areas such as The Markets in Crypto-Assets (MiCA) regulation, Central Bank Digital Currencies (CBDCs), and the intersection of blockchain with emerging technologies like the Internet of Things (IoT) and artificial intelligence (AI), emphasizing their applicability in enhancing food supply chain integrity, quality assurance, and sustainability. Furthermore, the curriculum addresses critical themes like ethical considerations, governance, and adoption strategies for small and medium-sized enterprises (SMEs), providing learners with a holistic understanding of the challenges and opportunities presented by blockchain technology in the agri-food sector. The deliverable concludes with a synthesis of the key findings and insights garnered from the development and implementation of the TRUSTFOOD Learning Ecosystem, offering a roadmap for the future use of blockchain technologies in the food supply chain.

The TRUSTFOOD Learning Ecosystem marks a notable development in the agrifood sector's integration of blockchain technology. Contributions from content providers, consultants, and infrastructure specialists have shaped a robust educational framework, offering engaging content that meets high educational standards and enhances user experience across multiple platforms. The courses focus on practical and interactive learning, covering key topics from blockchain fundamentals to specific applications like traceability and smart contracts.

Throughout D3.2 it is evident that the strategic development and implementation followed by the consortium have set a strong foundation for future advancements. We are confident that the courses developed will play a crucial role in shaping the future of digital learning and blockchain application in the food supply chain.

1. Introduction

The TRUSTFOOD project will design and implement Blockchain courses, tailored to re-skill and up-skill employees and job seekers in the agri-food sector. The project aims to foster the development of advanced digital skills of people among the labour force, prioritizing small and medium-sized enterprises (SMEs), as well as job seekers. This will be achieved by offering them access to specialized training courses that align with the most recent advancements in Blockchain technology, particularly its comprehensive applications within the Food Supply Chain (FSC).

TRUSTFOOD plans to create and implement short-duration training courses designed to enhance and refresh the skills of the labour force. The courses will be designed with a strong emphasis on practical knowledge about Blockchain and its relevance to the FSC.

The TRUSTFOOD project - which started in January 2023 and will run until December 2025 - is made up of a consortium of 14 partners plus one affiliated entity from the European Union (EU) and Ukraine: REZOS BRANDS SA (coordinator), Agricultural University of Athens, University of Nicosia/Institute For the Future (IFF), Wageningen University & Research, Uni Systems LUX, 482.solutions, UBITECH, INSME – The International Network for Small and Medium Enterprises, ITC – Innovation Technology Cluster, Lithuanian Food Exporters Association (LitMEA), Kyiv Academic University, DIH AgriFood Croatia, Green Point – short food supply chain and Smart Agro Hub, and AgroTransilvania Cluster (ATC) plus UniSystems EL.

Aim and Objectives of the TRUSTFOOD Learning Ecosystem (T3.2)

The TRUSTFOOD Learning Ecosystem (T3.2) aims to revolutionize the food supply chain by educating the industry on the benefits of incorporating blockchain technology into the agri-food sector. At the core of this initiative is the development of an integrated learning environment that leverages both theoretical knowledge and interactive learning to enhance the effectiveness of the training process.

The ecosystem seeks to educate people in the labour force, with a focus on SMEs, as well as job seekers, on cutting-edge practices in the food sector, through the use of innovative technological solutions, such as blockchain for traceability and smart contracts, and modern e-learning approaches like quizzes and videos. This dual approach ensures that learners not only acquire theoretical knowledge but also gain practical experience in applying these technologies, thereby fostering a deeper understanding and skillset.

The objectives of the TRUSTFOOD Learning Ecosystem are multifaceted and aim to cater to a wide array of learning needs and styles. One of the primary objectives is the redesign of traditional learning materials into interactive online short training courses. This includes the creation of two comprehensive Handbooks (one for trainees and one for trainers) and the design of short courses, which will feature a common introductory structure, multiple lessons with varied learning objectives, and a blend of text, slides, interactive videos, and gamification elements. These courses are intended to provide a holistic view of blockchain in the food supply chain, with each lesson designed to target specific cognitive objectives and learning outcomes, thereby ensuring a thorough and engaging learning experience.

Moreover, the TRUSTFOOD project emphasizes the active engagement and participation of trainees through its learning approach. By involving trainees in the practical application of blockchain technologies, the

ecosystem aims to cultivate an immersive learning environment that encourages interactive learning and active problem-solving. Additionally, the project implements an e-learning platform, supported by content providers, consultants, and advanced learning management systems, to facilitate both synchronous and asynchronous learning methodologies.

2. Learning Ecosystem Entities

The TRUSTFOOD Learning Ecosystem is an environment tailored to maximize the efficiency and impact of digital education within the scope of Blockchain application in the FSC. The TRUSTFOOD Learning Ecosystem involves several key entities, each playing a crucial role in the delivery and optimization of educational content. The breakdown of the ecosystem's entities is presented in Figure 1 and described in detail below.

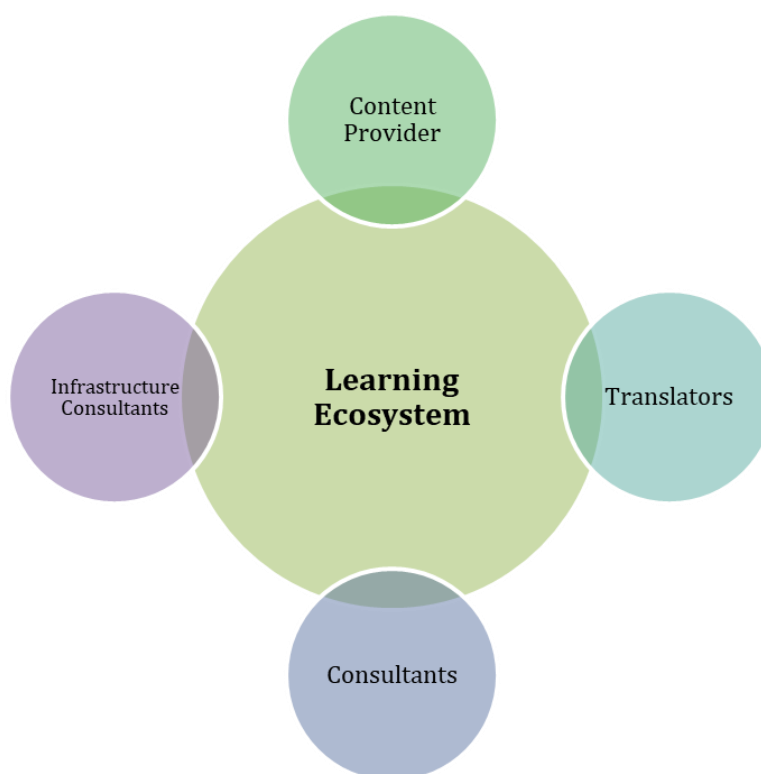


Figure 1: Learning Ecosystem Entities

Content Providers: The Content Providers are at the core of the ecosystem, bringing expertise in Blockchain technologies and digital learning to create engaging and relevant courses. Specifically, they are responsible for designing the course structure, the objectives, aims and the learning path of each course, developing the content material of each course and aligning the content with the latest industry developments. Additionally, the Content Providers are responsible for creating a variety of multimedia resources, such as videos, slides, and assessments (e.g. questions and quizzes), to support diverse learning preferences and reinforce key concepts.

Consultants: The Consultants (or Reviewers) are education experts in blockchain and the food supply chain, and they serve as consultants to oversee the quality and alignment of course materials with learning objectives. Their responsibilities include reviewing content to ensure that it adheres to educational standards and learning outcomes, offering insights on instructional design to facilitate effective knowledge transfer and retention, and finally providing iterative feedback to content providers, guiding the refinement process to enhance the clarity and impact of the course material.

Infrastructure Consultants: The Infrastructure Consultants are the link between the Learning Ecosystem and the TRUSTFOOD Learning Platform. They focus on establishing a robust technical framework that supports the delivery of content across multiple platforms and devices and ensuring that all educational tools and resources are harmoniously integrated for a smooth user experience.

Translators: Finally, the Translators are responsible for translating all courses with all involved material from English (which is the baseline language for the course creation) to six other languages (i.e., Greek, Italian, Romanian, Lithuanian, Slovenian, and Ukrainian).

3. Learning Ecosystem Methodology

The methodology shaping the TRUSTFOOD Learning Ecosystem is the product of a collective effort involving the involved entities as those described in Chapter 2. These entities are the pillars of the TRUSTFOOD Learning Methodology, guiding every step from the initial ideas to the wide-reaching delivery of the educational content. Figure 2 captures this entire process, showing a workflow that starts with the brainstorming of course ideas and evolves through to their final form and continuous improvement.

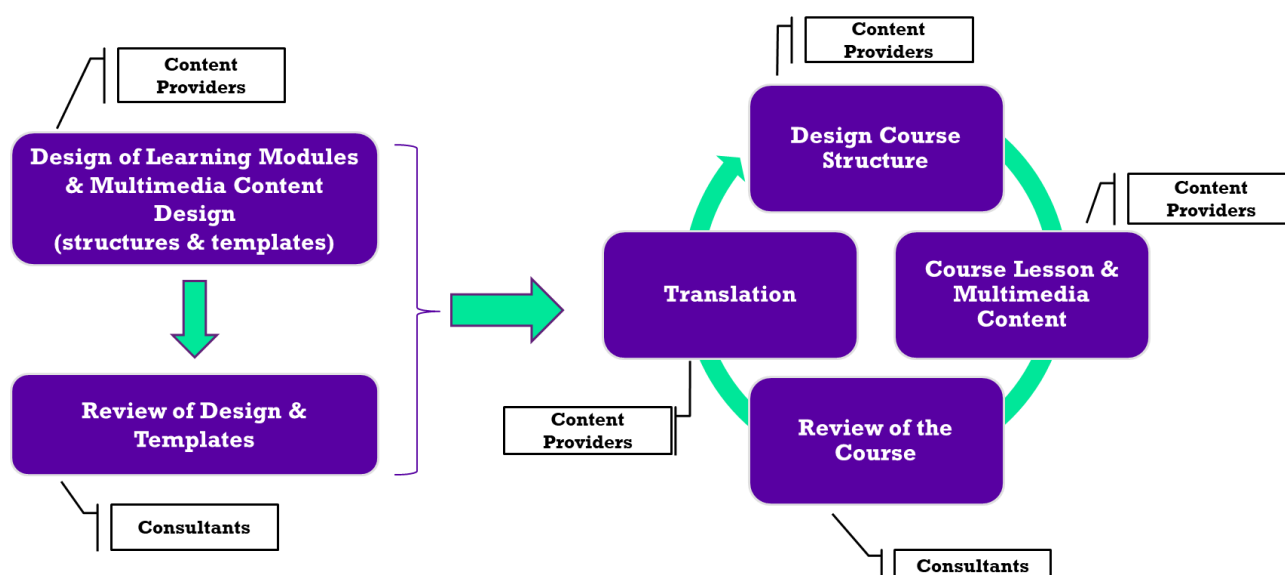


Figure 2: Learning ecosystem methodology

In the first stage, a collective brainstorming session was the catalyst for the development process. Content Providers, Consultants, and Infrastructure Consultants undertook a brainstorming towards identifying potential courses. The results of this collaboration were analysed by the Consultants, who brought a critical eye to the initial proposals. After a thorough review, the Ecosystem resulted in a set of 20 courses that are aimed to effectively meet the educational needs of the intended audiences. The list of the 20 courses provided, is presented as in Table 1.

Table 1: List of TRUSTFOOD Courses

Course #	Title
1	Introduction to Blockchain Technology and Digital Assets
2	Exploring Digital Asset Management and Tokenization
3	MiCA (The Markets in Crypto-assets) Regulation and CBDC (Central Bank Digital Currency)
4	FinTech with Example Applications in Food Supply Chain
5	Tokenization with Example Applications in Food Supply Chain
6	Introduction to Blockchain in the Food Supply Chain: Building Trust and Ensuring Safety
7	Basic Blockchain Skills
8	Advanced Blockchain Skills
9	Areas of application for Blockchain Technology
10	Smart Contracts with Example Applications in Food Supply Chain
11	Blockchain platforms
12	Blockchain and Traceability in relation to Food Supply Chain Integrity
13	Blockchain Applications for Food Quality Assurance and Certification
14	“ESG and SDGs in Food Supply Chain using Blockchain Technology
15	Climate Action, Energy transition and Blockchain in Food Supply chain
16	Blockchain Adoption Strategies for Small and Medium-sized Enterprises in the Food Sector
17	Ethical Considerations and Governance in Blockchain-enabled Food Supply Chains
18	Combined Powers: Blockchain and Internet of Things in Transforming the Food Supply Chains
19	Combined Powers: Blockchain and Artificial Intelligence in Transforming the Food Supply Chain
20	Roadmap for the use of Blockchain Technologies in the Food Supply

Following this selection, Content Providers began crafting the courses’ design and structure, ensuring that the foundational design was both comprehensive and clear. After laying out the structure, key objectives, and learning outcomes for each course, the Consultants re-examined the courses’ design, offering feedback

to guarantee that the educational soundness was in line with the practical applications of blockchain in the food supply chain.

This iterative phase was critical, as the Consultants' reviews often prompted to revisions, creating a feedback loop that refined the designs before they moved into the content development and translation.

Once the course designs were completed, the process transitioned into the development of content and assessments, and multimedia material. In that stage, Content Providers produced detailed lesson plans, multimedia materials, as well as formative and summative assessments that would later be tested for effectiveness and engagement. Similar to the design process, all the developments of all courses went through thorough reviews from the Consultants.

Upon successful review and revision of the courses, the translation was the next crucial phase. TRUSTFOOD partners translated all course materials into six languages, ensuring the broadest possible access to our learning ecosystem.

Upon the completion of translations, a final review of the courses took place, where Consultants assessed the full course content—in *multiple languages*—to affirm its educational efficacy.

Finally, it is worth mentioning that the methodology followed was a collaborative effort among the TRUSTFOOD Learning Ecosystem. To that end, Table 2 presents the assigned Content Providers, Consultants and Translators in each course.

Table 2: Involved entities in each course

Course #	Content Provider	Consultant (Reviewer)	Translator					
			Greek	Italian	Romanian	Lithuanian	Slovenian	Ukrainian
1	482.solutions	UNIC	REZOS	INSME	ATC	LITMEA	Green Point	482.solutions
2	UNIC	REZOS	REZOS	INSME	ATC	LITMEA	Green Point	482.solutions
3	UNIC	SAH	REZOS	INSME	ATC	LITMEA	Green Point	482.solutions
4	UNIC	WU	REZOS	INSME	ATC	LITMEA	Green Point	482.solutions
5	UNIC	482.solutions	REZOS	INSME	ATC	LITMEA	Green Point	482.solutions
6	UNIC	UNI LUX	SAH	INSME	ATC	LITMEA	Green Point	482.solutions
7	482.solutions	UNIC	SAH	INSME	ATC	LITMEA	Green Point	482.solutions
8	482.solutions	UNIC	SAH	INSME	ATC	LITMEA	Green Point	482.solutions
9	UNIC	UBITECH	SAH	INSME	ATC	LITMEA	Green Point	482.solutions

10	Rezos Brands S.A.	UNIC	SAH	INSME	ATC	LITMEA	Green Point	482.solutions
11	UNIC	482.solutions	AUA	INSME	ATC	LITMEA	Green Point	482.solutions
12	WU	UNIC	AUA	INSME	ATC	LITMEA	Green Point	482.solutions
13	AUA	GREEN POINT	AUA	INSME	ATC	LITMEA	Green Point	482.solutions
14	482.solutions	UNIC	AUA	INSME	ATC	LITMEA	Green Point	482.solutions
15	482.solutions	AFC	AUA	INSME	ATC	LITMEA	Green Point	482.solutions
16	UNIC	AUA	UNIC	INSME	ATC	LITMEA	Green Point	482.solutions
17	UNIC	ATC	UNIC	INSME	ATC	LITMEA	Green Point	482.solutions
18	UNIC	LITMEA	UNIC	INSME	ATC	LITMEA	Green Point	482.solutions
19	Rezos Brands S.A.	UNIC	UNIC	INSME	ATC	LITMEA	Green Point	482.solutions
20	AFC - AGRIFOOD CROATIA	INSME	UNIC	INSME	ATC	LITMEA	Green Point	482.solutions

4. Design of Educational Courses

4.1 Overview of the Educational Courses

The educational framework of the TRUSTFOOD project is designed to equip stakeholders in the food supply chain, particularly those involved in SMEs, as well as job seekers with the advanced digital skills necessary to master in blockchain technology. These courses, aim to provide accessible training that addresses both theoretical and practical aspects of blockchain applications in the food sector. TRUSTFOOD offers 20 courses, translated into six languages: Greek, Italian, Romanian, Lithuanian, Slovenian and Ukrainian, resulting in 140 distinct courses, as depicted in Figure 3.

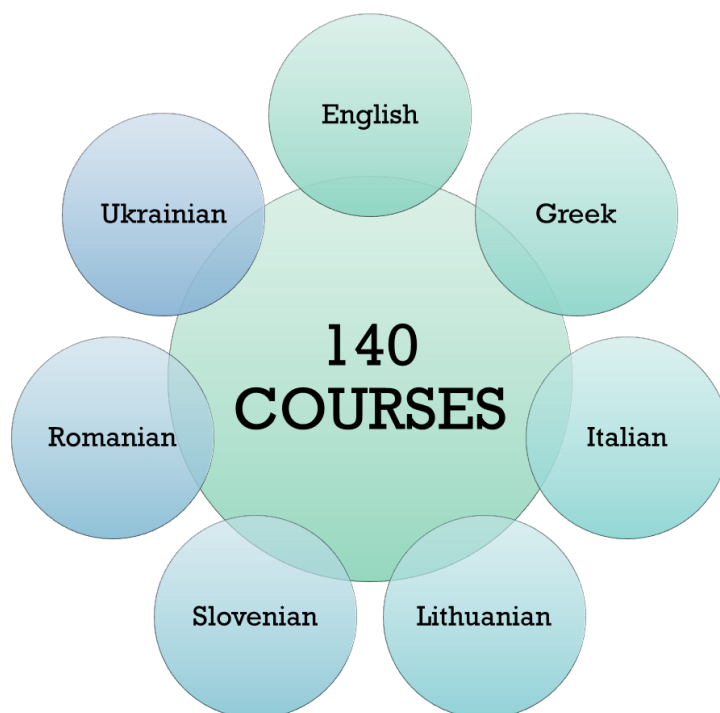


Figure 3: Number of distinct courses.

Each course within the TRUSTFOOD Learning Ecosystem adheres to a standardized structure that facilitates ease of learning and consistency across the educational platform. The courses are designed to progress from introductory topics to more advanced concepts, ensuring a thorough understanding of blockchain technologies and their implications for food supply chain management, digital assets, and regulatory compliance. Each course consists of multiple lessons tailored to its specific objectives. Furthermore, each lesson includes at least a presentation of the material, formative assessments in the form of questions and summative assessments in the form of quizzes. Interactive approaches such as videos will also be incorporated, as detailed in D3.4. The standardized design followed in all courses is presented in Figure 4.

The following sub-sections will present the design of each course, providing insights into their structure, objectives, and the educational tools employed to facilitate effective learning outcomes.

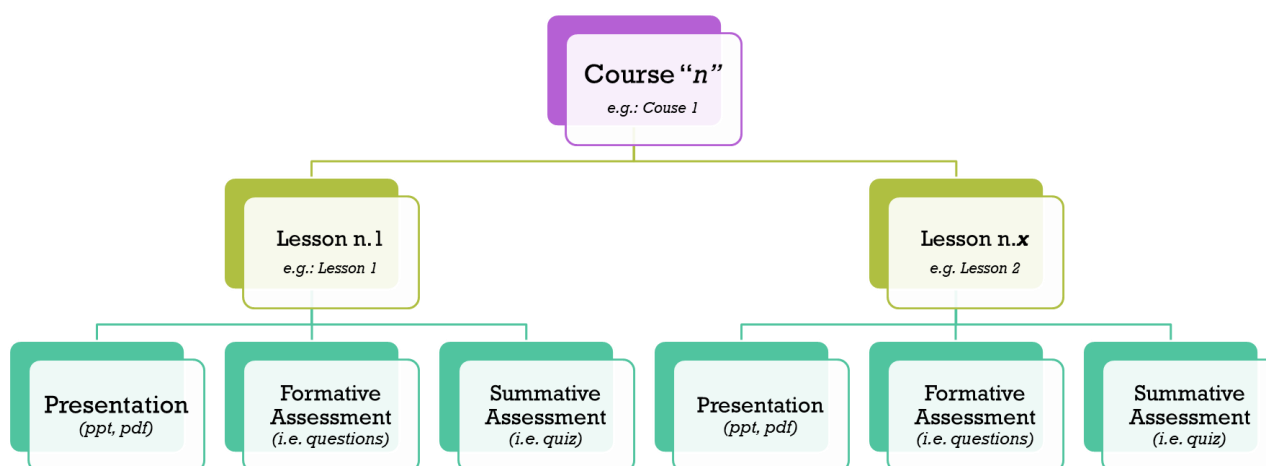


Figure 4: Courses' standardized design.

4.2 Detailed Design of the Courses

This section provides a breakdown of each course offered within the TRUSTFOOD Learning Ecosystem, outlining the course structure, key objectives and learning outcomes, theoretical and experiential approaches, and tools and methods utilized.

4.2.1 Course 1 - Introduction to Blockchain Technology and Digital Assets

Course #1 (developed by 482.solutions), serves as a gateway into the world of blockchain. Spanning a total duration of four hours, this course provides an exploration of blockchain's historical development, its fundamental principles and its significant impact across various sectors, including digital finance and supply chains. It is designed to cater to both beginners and individuals with prior knowledge, aiming to build a robust understanding of blockchain technology and digital assets through a combination of theoretical foundations and practical applications. This course equips participants with the necessary tools and insights to confidently navigate and apply blockchain solutions in real-world scenarios.

Course structure

This course is divided into a series of lessons, each designed to tackle a different aspect of blockchain technology. Spanning a total of 4 hours, the structure is tailored to optimize learning without overwhelming the participants. Each lesson, ranging from 25 to 45 minutes, covers specific topics from the origins of money to the latest in blockchain applications like DeFi and smart contracts. The format is designed to accommodate self-paced online learning, with additional time allotted for interactive activities (e.g. quizzes, videos etc.). This layout ensures a thorough understanding of each topic, supported by interactive elements and practical case studies, enhancing the learning experience. Table 3 presents the design of Course #1.

Table 3: Design of Course #1

Lesson	Lesson Title	Total Course Duration
1	History of money and blockchain technology	Approximately 4 hours
2	Fundamentals of blockchain technology	
3	Blockchain technology and transactions	
4	Blockchain Management System, Composition and types	
5	Bitcoin and Ethereum Basics	
6	DeFi (Decentralized Finance)	
7	Blockchain in Food Supply Chain: An Outlook	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: History of Money and Blockchain Technology

- **Objectives:** Understand the evolution of money and the emergence of blockchain technology as a disruptive force.
- **Content:** This lesson provides a brief history of money and traces the development of blockchain technology, highlighting its potential to revolutionize financial systems.

Lesson 2: Fundamentals of Blockchain Technology

- **Objectives:** Grasp the core principles of blockchain technology, including cryptography.
- **Content:** We'll delve into cryptography's role in securing blockchain, define and explore the concept of blockchain, and examine the fundamental principles that govern blockchain systems.

Lesson 3: Blockchain Technology and Transactions

- **Objectives:** Explore how transactions function within a blockchain system.
- **Content:** This lesson focuses on the mechanics of transactions on a blockchain, exploring the process and the security measures in place.

Lesson 4: Blockchain Management System: Composition and types

- **Objectives:** Understand the distributed ledger technology (DLT) concept and differentiate between private and public blockchain systems.
- **Content:** We'll define Distributed Ledger Technology (DLT) and explore the various types of blockchain systems, including public and private blockchains, highlighting their properties and functionalities.

Lesson 5: Bitcoin and Ethereum Basics

- **Objectives:** Gain an introductory understanding of Bitcoin and Ethereum, the two most prominent blockchain platforms.
- **Content:** This lesson introduces Bitcoin and its core features, followed by an exploration of Ethereum's unique capabilities, including smart contracts and Decentralized Applications (DApps).

Lesson 6: DeFi (Decentralized Finance)

- **Objectives:** Explore the emerging field of Decentralized Finance (DeFi) and its key components.
- **Content:** We'll differentiate between tokens and coins, explore token standards, and delve into the world of DeFi, including Non-Fungible Tokens (NFTs) and their role in decentralized finance.

Lesson 7: Blockchain in Food Supply Chain: An Outlook

- **Objectives:** Examine a potential application of blockchain technology in the food supply chain.
- **Content:** This lesson concludes the course by examining how blockchain can enhance transparency, traceability, and sustainability within the food industry.

Key Objectives and Learning Outcomes

In this course, students will go through blockchain technology, exploring its fundamental principles, diverse architectures, and various applications. From understanding the intricate components that ensure blockchain's security and immutability, to examining its transformative potential in industries like the food supply chain, this course is designed to equip learners with a robust foundation in blockchain and its practical implications across different sectors. Course's #1 objectives are the following:

- **Understand the fundamentals of blockchain technology:** Students will gain a comprehensive understanding of the basic concepts and principles underlying blockchain technology.
- **Comprehend the architecture and components of a blockchain:** Students will learn about the structure and components of a blockchain, including blocks, transactions, public and private keys. They will grasp how these elements work together to ensure security and immutability.
- **Understand different types of blockchains:** Students will explore the distinctions between public, private, and consortium blockchains. They will analyse the advantages, disadvantages, and suitable use cases for each type.
- **Explore digital assets and cryptocurrencies:** Students will gain an understanding of digital assets, including cryptocurrencies, tokens, and non-fungible tokens (NFTs). They will examine the concepts of wallets, private keys, public keys, and explore the mechanisms of transacting and storing digital assets securely.
- **Understand the benefits of implementing blockchain in the food supply chain:** Students will learn how blockchain technology can improve transparency and traceability within the food supply chain and how blockchain can enhance food safety by tracking every stage of a product's journey, from farm to fork.

Upon completing this course, students will have a solid understanding of blockchain technology's core concepts, architectures, and types. They will be adept at differentiating between various blockchain models and appreciate how blockchain technology can be applied to real-world scenarios, such as improving transparency and efficiency in the food supply chain. Additionally, they will possess practical knowledge on managing digital assets, including cryptocurrencies and NFTs, safely and effectively.

Theoretical and experiential approaches to be adopted in the course

In this course, we blend theoretical knowledge with experiential learning to provide a comprehensive understanding of blockchain technology. The curriculum is strategically designed to offer students a solid theoretical foundation through clear explanations and supportive materials. This foundation is further enriched by experiential learning opportunities, including interactive exercises and real-world case studies, which are integral to applying theoretical insights in practical settings. This dual approach ensures that students not only learn the concepts but also understand how to implement them effectively in various industries.

Theoretical Approaches:

- **Clear Explanations:** Each lesson starts with clear definitions and in-depth explanations of key blockchain concepts.
- **Solid Base:** Readings, presentations, will solidify students' understanding of core principles and functionalities.

Experiential Approaches:

- **Interactive questions:** Interactive exercises and quizzes will challenge students to apply their understanding of the learned material.
- **Case studies:** Case studies will expose students to real-world applications of blockchain technology across diverse industries.

Tools and methods to be provided on the course

This course employs a variety of engaging methods to equip the students with a comprehensive understanding of blockchain technology. Here's what you can expect:

Structured Learning:

- **Presentations:** Each lesson is accompanied by detailed presentations outlining key concepts, processes, and real-world examples.
- **Recommended Readings:** A curated list of articles, books, and papers will be offered for further exploration of specific topics, allowing students to delve deeper into the subject matter.

Interactive Engagement:

- **Interactive Questions:** Live sessions will incorporate interactive questions to test students' knowledge, stimulate critical thinking, and foster a dynamic learning environment.

4.2.2 Course 2 - Exploring Digital Asset Management and Tokenization

Course 2 (*developed by UNIC*) is an intermediate-level course designed to enhance the learners' knowledge on blockchain technology within the agrifood supply chain. Aimed at professionals of any age and occupation in the supply chain and logistics sectors, this course deepens the understanding of digital assets and explores their transformative potential through tokenization. Spanning approximately 5 hours and organized into eight engaging lessons, the course facilitates a thorough comprehension of various digital assets, including non-fungible tokens (NFTs), utility tokens, and security tokens. Participants will explore how these assets can be managed and optimized using blockchain technology to drive innovation and efficiency within the food industry. Key topics such as tokenization, digital assets, supply chain management, case studies, and future trends are threaded throughout the course, ensuring a comprehensive learning experience that aligns with the latest industry developments.

Course structure:

The structure of this course is designed to facilitate a comprehensive learning journey. It is segmented into eight lessons, each designed to build upon the last, culminating in a well-rounded mastery of digital asset management and tokenization. The course content, enriched with detailed presentations and supplemented with interactive videos, including external resources and instructional videos, makes complex concepts accessible and engaging. Table 4 presents the design of Course #2.

Table 4: Design of Course #2

Lesson	Lesson Title	Course Duration
1	Contextualizing Blockchain in the Agrifood Supply Chain	Approximately 5 hours
2	Introduction to digital assets in the food supply chain	
3	Types of digital assets	
4	The Interplay Between Digital Assets and the Agrifood Supply Chain	
5	The Fundamentals of Digital Asset Management	
6	Potential benefits and challenges of digital asset management and tokenization in the agrifood industry	
7	Exploring Real-world Implementations	
8	Future trends and advancements in digital asset management and tokenization	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Contextualizing Blockchain in the Agrifood Supply Chain

- **Objective:** Understand the importance and potential impact of blockchain technology in the agrifood sector, alongside the basic concepts of blockchain and smart contracts.
- **Content:** Introduction to blockchain technology, its significance in the agrifood supply chain, and an overview of smart contracts.

Lesson 2: Introduction to Digital Assets in the Food Supply Chain

- **Objective:** Explore what digital assets are and their role in the food supply chain.
- **Content:** Definition and types of digital assets, with an emphasis on their application in the food industry.

Lesson 3: Types of Digital Assets

- **Objective:** Dive deeper into the specific types of digital assets: NFTs, utility tokens, and security tokens.
- **Content:** Characteristics, uses, and implications of NFTs, utility tokens, and security tokens in the agrifood sector.

Lesson 4: The Interplay Between Digital Assets and the Agrifood Supply Chain

- **Objective:** Understand how digital assets can transform the food supply chain and their impact on various stakeholders.
- **Content:** The transformative potential of digital assets for producers, consumers, and intermediaries.

Lesson 5: The Fundamentals of Digital Asset Management

- **Objective:** Explore digital asset management and the role of blockchain in this domain.
- **Content:** Key concepts in digital asset management, including the utilization of blockchain technology.

Lesson 6: Potential Benefits and Challenges of Digital Asset Management and Tokenization in the agri-food industry

- **Objective:** Analyse the benefits and challenges of implementing digital asset management and tokenization in the agrifood industry.
- **Content:** Discussion on potential benefits such as transparency and efficiency, alongside challenges like regulatory issues and technology adoption barriers.

Lesson 7: Exploring Real-world Implementations

- **Objective:** Examine case studies and real-world implementations of digital asset management and tokenization in the agrifood sector.
- **Content:** Analysis of successful and challenging real-world implementations, and key takeaways.

Lesson 8: Future Trends and Advancements in Digital Asset Management and Tokenization

- **Objective:** Identify and discuss future trends and potential advancements in the field of digital asset management and tokenization.
- **Content:** Emerging technologies, regulatory trends, and potential market shifts in the agrifood sector.

Key objectives and learning outcomes:

The core objectives and learning outcomes of this course are designed to ensure that learners will not only understand the theoretical underpinnings of digital assets and tokenization but can also apply this knowledge practically within the food supply chain context. By the end of this course, participants will be able to:

- Grasp the core principles of digital assets and tokenization, particularly within the agrifood supply chain.
- Learn how blockchain technology underpins efficient digital asset management and tokenization in the food industry.
- Utilize knowledge of digital assets and tokenization to address and solve real-world challenges within the food supply chain.

Through Course 2: Exploring Digital Asset Management and Tokenization, learners will develop an understanding of the foundational principles of blockchain technology and its role in the creation, management, and execution of digital transactions within the agrifood sector. The course will enable participants to engage in critical analysis, assessing the multifaceted benefits and challenges that come with integrating digital asset management and tokenization into agrifood supply chains. It will provide them with the ability to scrutinize the effects of these technologies on various stakeholders, including producers, consumers, and intermediaries. Additionally, the course aims to equip learners with the foresight to identify emerging trends and potential advancements in digital asset management and tokenization. By the end of their learning experience, they will be prepared to anticipate and navigate future developments in the agrifood industry, positioning themselves at the forefront of innovation in digital asset management.

Theoretical and experiential approaches to be adopted in the course:

Course 2 employs a blend of theoretical frameworks and real-world applications. This dual approach empowers learners to connect complex concepts with tangible experiences in the field, facilitating a more profound and enduring comprehension.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines constructivism, humanism, and connectivism, ensuring a comprehensive and engaging learning experience. The course starts with a foundational exploration of blockchain and smart contracts, setting the stage for deeper dives into specific types of digital assets, including non-fungible tokens (NFTs), utility tokens, and security tokens. By elucidating the nature and function of these digital assets, the course facilitates a nuanced understanding of their potential impact and applications in the food supply chain. The theoretical framework is designed to not only impart knowledge but also to contextualize digital assets within broader economic and technological landscapes, providing learners with a comprehensive view that aligns with current industry practices and innovations. This approach ensures that participants can critically analyse and evaluate the benefits and challenges of digital asset management and tokenization in practical, real-world contexts.

Experiential Approaches:

Experiential learning is a fundamental aspect of this course, allowing participants to engage directly with blockchain technologies. Through interactive scenarios and case studies, learners will apply their knowledge in simulated environments reflective of the current agrifood industry landscape. Specifically, this course provides:

- **Interactive Questions:** Many interactive questions are provided throughout this course to engage the learners with the course materials.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

A set of selected tools and methods will also be provided to enrich the learning experience. Each lesson is supported by detailed presentations, questions for formative assessment, quizzes for summative assessment, and diverse video resources to illuminate the subject matter from multiple perspectives.

- **Course Presentations:** Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.3 Course 3 - MiCA Regulation and CBDC

Course 3 (*developed by UNIC*) offers an advanced exploration into the Markets in Crypto-assets (MiCA) regulation and the emerging concept of Central Bank Digital Currencies (CBDCs). This course is designed to provide professionals in any sector, particularly those in financial services, with an in-depth understanding of how these regulatory and technological innovations impact the financial system and intersect with the food supply chain. As a continuation of foundational blockchain knowledge, this course delves deeper into specific regulations and digital financial instruments that are shaping the future of digital economies.

Course structure:

MiCA Regulation and CBDCs are structured to methodically unfold the complex landscape of digital currency regulation and its operational dynamics within the global economy and specifically in the food industry. This section will outline the course's flow from introductory concepts to more detailed regulatory analysis and case studies. Table 5, present the design of Course #3.

Table 5: Design of Course #3

Lesson	Lesson Title	Course Duration
1	Introduction to MiCA: Its Origins, Principles, and Objectives	Approximately 4 hours
2	Detailed Analysis of MiCA Regulation: What does it mean for businesses and individuals dealing with crypto-assets	
3	Introduction to Central Bank Digital Currencies (CBDCs): The case for CBDCs, how they function, and their role in the global economy	
4	The Impact of MiCA Regulations and CBDCs on the Food Supply Chain	
5	Case Studies of CBDCs	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to MiCA: Its Origins, Principles, and Objectives

- **Objective:** Gain a foundational understanding of the Markets in Crypto Assets (MiCA) regulation, including its historical context, key principles, and legislative significance in the EU's regulatory landscape.
- **Content:** Exploration of MiCA's conception, foundational principles, classifications and requirements for crypto-assets, and the impact on various stakeholders.

Lesson 2: Detailed Analysis of MiCA Regulations: What does it mean for businesses and individuals dealing with crypto-assets

- **Objective:** Understand the implications of MiCA regulations for businesses and individuals in the crypto-asset space.
- **Content:** In-depth examination of MiCA regulations and their practical significance for crypto-asset issuers and service providers.

Lesson 3: Introduction to Central Bank Digital Currencies (CBDCs): The case for CBDCs, how they function, and their role in the global economy

- **Objective:** Comprehend the basics, rationale, and global impact of CBDCs, including their role in the financial system.
- **Content:** Fundamental principles of CBDCs, differences from traditional currencies, and the driving forces behind their adoption.

Lesson 4: The Impact of MiCA Regulations and CBDCs on the Food Supply Chain

- **Objective:** Explore how MiCA and CBDCs influence crypto payments and the tokenization of food products within the supply chain.
- **Content:** Analysis of traditional vs. crypto payments in the food supply chain, opportunities, challenges, and future trends at the intersection of blockchain technology, MiCA, and CBDCs.

Lesson 5: Case Studies of CBDCs

- **Objective:** Dive into the competitive landscape of CBDCs through global initiatives and real-world case studies.
- **Content:** Examination of CBDC pilot projects, implementations worldwide, and the outcomes of these initiatives.

Key objectives and learning outcomes:

This section defines what learners will achieve by the end of this course, including a deep understanding of MiCA and CBDCs, and their practical implications for businesses and the food supply chain. By the end of this course, participants will be able to:

- Understand the Markets in Crypto Assets (MiCA) regulation and its objectives.
- Gain knowledge about Central Bank Digital Currencies (CBDCs) and their role in the financial system.
- Comprehend the interplay of MiCA, CBDCs, and the food supply chain.

Upon completing this course, participants will have a thorough understanding of the Markets in Cryptoassets regulation and the role and function of Central Bank Digital Currencies. Learners will grasp the significance of MiCA within the regulatory framework governing digital assets and appreciate the strategic purpose of CBDCs in modern financial systems. They will explore the implications of these regulations and technologies within the food supply chain, particularly how they affect the tokenization of food products and the use of cryptocurrencies in transactions. Furthermore, the course will equip participants with the foresight to anticipate and understand potential future developments in the regulatory landscape affecting digital currencies and assets.

Theoretical and experiential approaches to be adopted in the course:

The course integrates theoretical knowledge with real-world applications, ensuring learners can bridge the gap between regulatory concepts and their practical impacts on the financial services industry and beyond.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. The theoretical foundation of “MiCA Regulation and CBDCs” is built upon a detailed analysis of the MiCA framework and the operational principles of CBDCs. The course discusses the origins, objectives, and principles of MiCA, providing learners with a comprehensive background necessary to navigate the regulatory landscape. Similarly, it introduces CBDCs, explaining their purpose, functionality, and their growing role in the global economy. By connecting these concepts with their practical implications for the food supply chain, the course ensures that learners not only understand the theoretical aspects but also how to apply this knowledge in practical business and regulatory scenarios.

Experiential Approaches:

Engaging with practical scenarios and case studies, learners will apply their understanding of MiCA and CBDCs to real-world situations, enhancing their ability to navigate this rapidly evolving field. Specifically, Course #3 provides:

- **Interactive Questions:** Engaging learners with interactive questions and fostering debates during live sessions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

Course #3 utilizes a range of instructional tools to facilitate an effective learning experience. A variety of educational tools and methods will be utilized to deliver the course content effectively. This includes:

- **Course Presentations:** Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.

- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.4 Course 4 - FinTech with Example Applications in Food Supply Chain

Course #4 (*developed by UNIC*) dives into the dynamic world of FinTech and its transformative impact on the agrifood sector. This intermediate-level course is designed to guide professionals across various industries, particularly those in financial services, through the fundamental principles of FinTech and its key applications. By exploring real-world case studies, learners will gain insights into how FinTech innovations are reshaping the food supply chain, enhancing efficiency, traceability, and financial transactions.

Course structure:

This course is structured to provide an understanding of FinTech's role in the agrifood sector. Starting with basic concepts and moving through to advanced applications and case studies, each lesson builds upon the last to form a complete picture of how FinTech can revolutionize the food supply chain. Table 6 presents the design of Course #4.

Table 6: Design of Course #4

Lesson	Lesson Title	Course Duration
1	Introduction to FinTech: Understanding its components and key technologies	Approximately 4 hours
2	The impact of FinTech on various industries, with a focus on the agrifood sector	
3	FinTech and the Food Supply Chain Interplay	
4	Key FinTech applications in the food supply chain	
5	Exploring Real-world Implementations	
6	Future Trends	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to FinTech: Understanding its components and key technologies

- **Objective:** Understand the core concepts, underlying technologies, and advantages and disadvantages of FinTech.
- **Content:** Introduction to FinTech, key technologies driving FinTech, and its impact on the food supply chain.

Lesson 2: The impact of FinTech on various industries, with a focus on the agrifood sector

- **Objective:** Examine the transformative impact of FinTech on various industries, particularly the agrifood sector.
- **Content:** Impact of FinTech on banking, insurance, investment management, and the agrifood sector.

Lesson 3: FinTech and the Food Supply Chain Interplay

- **Objective:** Discuss how FinTech optimizes and secures transactions, improves data management, and enhances traceability in the agrifood supply chain.
- **Content:** Significance of FinTech in the food supply chain, supply chain finance, and key FinTech applications.

Lesson 4: Key FinTech applications in the food supply chain

- **Objective:** Identify and understand key FinTech applications that enhance efficiency, transparency, and sustainability in the food supply chain.
- **Content:** Digital payment systems, blockchain for traceability, smart contracts, and InsurTech.

Lesson 5: Exploring Real-world Implementations

- **Objective:** Explore digital asset management and the role of blockchain in this domain.
- **Content:** Key concepts in digital asset management, including the utilization of blockchain technology. Case studies, best practices, and stakeholder perspectives on FinTech integration.

Lesson 6: Future Trends

- **Objective:** Gain insights into emerging FinTech trends and explore the role of disruptive technologies in the agrifood sector.
- **Content:** Emerging trends in FinTech, sectoral influence, disruption, regulatory insights, and sustainability.

Key objectives and learning outcomes:

The primary objective of this course is to provide a comprehensive understanding of how Financial Technology (FinTech) integrates and transforms the food supply chain. This course aims to equip participants with the knowledge and skills needed to leverage FinTech innovations to enhance efficiency, transparency, and sustainability within the agrifood sector. Through a series of lessons, participants will explore the core concepts of FinTech, its impact on various industries, and specifically its role in optimizing the agrifood supply chain. Specifically, by the end of this course, participants will be able to:

- Understand Core Concepts and Technologies
- Analyse the Impact of FinTech on Industries
- Optimize Financial Transactions in the Agrifood Supply Chain
- Improve Data Management and Traceability
- Explore Key FinTech Applications
- Explore Emerging Trends and Future Directions

This course provides a holistic view of the intersection between FinTech and the food supply chain, highlighting the transformative potential of financial technologies in enhancing agrifood processes. By achieving the outlined objectives and learning outcomes, participants will be well-equipped to drive innovation and efficiency within their respective domains, leveraging FinTech to create more sustainable and transparent food supply chains.

Theoretical and experiential approaches to be adopted in the course:

The course integrates theoretical learning with practical application, ensuring that learners not only grasp FinTech concepts but also see how these concepts are applied in the agrifood sector to solve real challenges.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. These theoretical frameworks guide both the content delivery and the interactive elements of the course, aligning with the objectives of fostering understanding, practical application, and personal growth. The theoretical approach of this course centers on a detailed examination of FinTech, breaking down its components, technologies, and the mechanisms by which it influences the agrifood sector. Starting with a broad introduction to FinTech, the course progresses to specific technologies such as blockchain and AI, demonstrating their practical impact on food supply chain management. This theoretical foundation equips learners with the necessary tools to analyse and implement FinTech solutions effectively within their own operations.

Experiential Approaches:

Through engaging with practical examples and case studies, learners will have the opportunity to apply their theoretical knowledge, exploring how FinTech tools and techniques can be implemented to make tangible improvements within the food supply chain.

- **Interactive Questions:** Engaging learners with interactive questions, within each lesson. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

A variety of educational tools and methods will be utilised to deliver this course effectively. Detailed presentations will outline key concepts and technologies, while interactive resources and videos will provide further insights and real-world context. Quizzes and assessments will help reinforce learning and ensure mastery of the subject matter. Specifically Course #4 provides:

- **Course Presentations:** Each lesson includes a detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying

complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.

- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.5 Course 5 - Tokenization with Example Applications in Food Supply Chain

Course #5 (*developed by UNIC*) explores the innovative world of tokenization and its transformative impact on the agrifood sector. This course is designed for professionals across various levels, particularly those involved in food and agriculture. Additionally, it is an intermediate-level course that enhances understanding of tokenization processes, their underlying principles, and practical applications within the food supply chain.

Course structure:

This course unfolds the topic of tokenization starting with foundational concepts and progressing to more complex applications within the food supply chain. The curriculum is structured to facilitate a gradual build-up of knowledge, ensuring a thorough understanding of how tokenization can be effectively utilized in the agrifood sector. Table 7, present the design of Course #5.

Table 7: Design of Course #5

Lesson	Lesson Title	Course Duration
1	Introduction to Tokenization	Approximately 4 hours
2	The role of blockchain in tokenization	
3	Different types of tokens	
4	Tokenization in Food Supply Chain	
5	Exploring Real-world Implementations	
6	Future Trends	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to Tokenization

- **Objective:** Introduce the fundamental concept of tokenization and its significance in the agrifood sector.
- **Content:** Definition, operational process, advantages, and drawbacks of tokenization.

Lesson 2: The Role of Blockchain in Tokenization

- **Objective:** Explore the symbiotic relationship between blockchain technology and tokenization.
- **Content:** How blockchain technology enhances the tokenization process, enabling secure, transparent transactions.

Lesson 3: Different Types of Tokens

- **Objective:** Understand the fundamental categories of tokens and their specific applications, especially in the agrifood industry.
- **Content:** Governance Tokens, Utility Tokens, Security Tokens, Platform Tokens, Non-fungible Tokens (NFTs).

Lesson 4: Tokenization in Food Supply Chain

- **Objective:** Investigate the application of tokenization in the food supply chain for enhanced traceability, quality certification, and improved transparency.
- **Content:** Use cases of tokenizing food products, quality certifications, and the role of blockchain in secure tokenization.

Lesson 5: Exploring Real-world Implementations

- **Objective:** Analyse specific case studies highlighting the application of tokenization in the food industry.
- **Content:** Examination of real-world challenges and the benefits of tokenization for transparency, authenticity, and equity in the food system.

Lesson 6: Future Trends

- **Objective:** Look at expected trends, new cases, and potential challenges in tokenization within the agrifood sector.
- **Content:** Overview of the tokenization market's projected growth, emerging applications, and future technological and regulatory challenges.

Key objectives and learning outcomes:

This section outlines the specific knowledge and skills learners will acquire through the course. It emphasizes understanding tokenization's core principles, exploring its applications, and applying these concepts to real-world scenarios within the food supply chain. By the end of this course, participants will be able to:

- Understand the process and principles of tokenization.
- Explore the concept of tokenization and its applications.
- Learn how tokenization can be applied in the food supply chain.
- Study detailed examples of tokenization implemented in real-world food supply chain scenarios.

Upon completing this course, participants will have a thorough understanding of tokenization and its mechanisms. Learners will understand how blockchain technology underpins secure and transparent tokenization processes and will be able to distinguish between different types of tokens such as governance, utility, security, platform and NFTs. They will explore tokenization's practical applications in the food supply chain, such as enhancing traceability of food products, certifying quality and improving supply chain transparency. The course will also enable participants to critically assess and discuss real-world implementations of tokenization and consider future trends that may influence the agrifood sector.

Theoretical and experiential approaches to be adopted in the course:

Combining theoretical insights with practical applications, Course #5 ensures that learners not only grasp the concept of tokenization but also see its impact through case studies and real-world applications within the food supply chain.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. These theoretical frameworks guide both the content delivery and the interactive elements of the course, aligning with the objectives of fostering understanding, practical application, and personal growth. Furthermore, the theoretical framework of the course is built around a detailed examination of tokenization processes and their relevance to the food supply chain. Starting with the basics of what tokenization is and how it works, the course elaborates on the role of blockchain technology in enabling tokenization. By discussing various types of tokens and their specific applications in enhancing food supply chain operations, the course provides learners with the necessary tools to understand and implement tokenization solutions in their own sectors effectively.

Experiential Approaches:

In Course #5, learners will engage with various examples and case studies that demonstrate tokenization's role in the food supply chain, providing them with practical insights and the ability to apply theoretical knowledge in real-life scenarios.

- **Interactive Questions:** Engaging learners with interactive questions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

A comprehensive set of tools and methods will be provided to enhance learning and engagement. Detailed presentations, interactive resources, and video content will bring the subject matter to life, while quizzes and interactive discussions will help reinforce understanding and facilitate knowledge application.

- **Course Presentations:** Each lesson includes a detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.6 Course 6 - Introduction to Blockchain in the Food Supply Chain: Building Trust and Ensuring Safety

Course #6 (developed by UNIC) is designed to provide a foundational understanding of how blockchain technology can revolutionize the food industry by enhancing transparency, improving food safety, and building trust. Aimed at beginners and professionals across various sectors, this course explores the essential features of blockchain, such as immutability and decentralization, and demonstrates how these features can tackle real-world challenges in the food supply chain.

Course structure:

This course is structured to gradually introduce learners to the complexities of blockchain technology and its specific applications in the food supply chain. From understanding basic blockchain principles to exploring advanced applications for food safety and compliance, each lesson builds on the previous one to provide a comprehensive overview. Table 8, present the design of Course #6.

Table 8: Design of Course #6

Lesson	Lesson Title	Course Duration
1	Supply Chain Essentials and Challenges in the Food Industry	Approximately 6 hours
2	Blockchain Technology Essentials – Part I	
3	Blockchain Technology Essentials – Part II	
4	Role of Blockchain in Optimizing the Food Supply Chain	
5	Blockchain for Trust-building in the food supply chain	
6	Ensuring Food Safety through Blockchain	
7	Exploring Real-world Implementations	
8	Future Trends	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Supply Chain Essentials and Challenges in the Food Industry

- **Objective:** Offer an understanding of the key stages in the food supply chain and examine challenges from logistical issues to quality assurance.
- **Content:** Overview of the food supply chain, key stages, stakeholders, and common challenges faced.

Lesson 2: Blockchain Technology Essentials – Part I

- **Objective:** Introduce the fundamental concepts of blockchain technology, including its basic principles and key features like immutability and decentralization.
- **Content:** Basic principles of blockchain, how it works, and its importance.

Lesson 3: Blockchain Technology Essentials – Part II

- **Objective:** Equip participants with a thorough understanding of different types of blockchains and their unique characteristics.

- **Content:** Types of blockchain, advantages and disadvantages of each type, supplemented by real-world use cases.

Lesson 4: Role of Blockchain in Optimizing the Food Supply Chain

- **Objective:** Explore how blockchain technology can introduce transparency, traceability, and efficiency to positively change the food supply chain.
- **Content:** Opportunities blockchain technology presents for increased transparency, traceability, and efficiency in the food supply chain.

Lesson 5: Blockchain for Trust-Building in the Food Supply Chain

- **Objective:** Demonstrate how blockchain's inherent properties can serve as tools to bridge the trust deficit and ensure product journey integrity.
- **Content:** How blockchain enhances trust among stakeholders through immutability and transparency.

Lesson 6: Ensuring Food Safety through Blockchain

- **Objective:** Provide a clear understanding of blockchain's role in food safety and discuss its impact on enhancing food safety protocols.
- **Content:** Use of blockchain to track and verify food safety from farm to table, with real-world examples.

Lesson 7: Exploring Real-World Implementations

- **Objective:** Highlight blockchain technology usage in the food supply chain through detailed case studies.
- **Content:** Case studies showcasing blockchain implementations, discussion of challenges, and solutions applied.

Lesson 8: Future Trends

- **Objective:** Investigate potential future trends of blockchain in the food supply chain and analyze the possibilities for blockchain to drive innovation.
- **Content:** Expected advancements and challenges in blockchain technology within the food supply chain.

Key objectives and learning outcomes:

In this section, learners will discover the objectives they are expected to achieve, such as understanding blockchain's role in the food supply chain and learning from successful real-life blockchain implementations to enhance food safety and stakeholder trust. By the end of this course, participants will be able to:

- Understand blockchain technology and its application in the food supply chain.
- Discover how blockchain enhances transparency, improves food safety, and fosters trust in the food supply chain.

- Learn from real-life examples where blockchain has successfully addressed challenges in the food supply chain.

As learning outcome, participants will have a solid understanding of blockchain technology's basic principles and its transformative potential in the food supply chain. They will comprehend how blockchain fosters transparency and trust among stakeholders and improves operational efficiency through enhanced traceability and safety mechanisms. Additionally, learners will analyse real-life examples where blockchain has successfully mitigated challenges in the food industry, equipping them with the insights needed to foresee and adapt to future trends in blockchain applications within their professional domains.

Theoretical and experiential approaches to be adopted in the course:

The course combines theoretical knowledge with practical examples, providing a balanced learning experience that emphasizes both understanding of blockchain technology and its practical deployment in the food industry.

Theoretical Approaches:

The theoretical foundation of the course is laid out through a detailed exploration of blockchain technology's essential characteristics—immutability, decentralization, and consensus mechanisms. The course details how these features are crucial for applications in the food supply chain, particularly in improving transparency, traceability, and efficiency. Lessons progressively delve into more specific uses of blockchain, such as in ensuring food safety and compliance, providing learners with a comprehensive understanding of both the technology and its practical benefits in the food industry.

Experiential Approaches:

- Interactive Questions/Debate: Engaging learners with interactive questions and fostering debates during live sessions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- Case Studies: Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

Engaging with real-world case studies, learners will see firsthand how blockchain technology addresses common challenges in the food supply chain, enhancing their ability to apply this knowledge in practical settings.

- Course Presentations: Each lesson includes a detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- Interactive Resources: Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not

only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.

- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.7 Course 7 - Basic Blockchain Skills

The course (*developed by 482.solutions*) provides a comprehensive understanding of core concepts like hashing functions (SHA-256, Keccak) and their role in linking blocks within a blockchain. Students will also explore the significance of Nonces.

Beyond theoretical knowledge, the course equips students with practical skills. They'll learn to utilize block explorers and grasp transaction models like UTXO. Finally, the course clarifies the crucial connection between seed phrases, private keys, and addresses, solidifying a holistic understanding of blockchain fundamentals.

Course structure:

This course lays the foundation for understanding blockchain technology by exploring its core concepts and functionalities. Each lesson builds upon the previous one, equipping you with the essential knowledge to navigate the exciting world of blockchain. Table 9 presents the design of Course #7.

Table 9: Design of Course #7

Lesson	Lesson Title	Course Duration
1	Introduction to hash functions and their role in blockchain	Approximately 4.5 hours
2	Understanding Cryptocurrency Transactions	
3	Block Structure and Blockchain Connection	
4	Nonce	
5	Blockchain Explorers	
6	UTXO Transaction Model	
7	Seed Phrase, Private Key, and Address	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to hash functions and their role in blockchain

- **Objectives:** Grasp the concept of hash functions and their critical role in blockchain security.
- **Content:** This lesson explores hash functions, how they work to create unique fingerprints for data, and their critical role in ensuring blockchain's data integrity and security.

Lesson 2: Understanding Cryptocurrency Transactions

- **Objectives:** Understand the fundamental building block of blockchain - transactions.
- **Content:** We'll delve into the basic building blocks of cryptocurrency transactions, including senders, receivers, amounts, fees, and confirmation times.

Lesson 3: Block Structure and Blockchain Connection

- **Objectives:** Decipher the structure of individual blocks and how they connect to form a blockchain.
- **Content:** This lesson unpacks the structure of blocks within a blockchain, explaining how hashing functions link them together to create a secure and tamper-proof chain.

Lesson 4: Nonce

- **Objectives:** Understand the concept of Nonce and its crucial role in blockchain mining and security.
- **Content:** We'll explore the concept of Nonce, a critical element in block validation and mining that helps secure the blockchain network.
- **Lesson 5: Blockchain Explorers Objectives:** Understand the purpose of block explorers and their significance in analysing blockchain data.
- **Content:** This lesson introduces block explorers, powerful tools for analyzing blockchains, allowing you to verify transactions and navigate blockchain data.

Lesson 6: UTXO Transaction Model

- **Objectives:** Explore the UTXO (Unspent Transaction Output) model, a core concept in Bitcoin transactions.
- **Content:** We'll explore the UTXO model, a unique way Bitcoin handles transactions by tracking unspent outputs and how they are used as inputs for new transactions.

Lesson 7: Seed Phrase, Private Key, and Address

- **Objectives:** Understand the relationship between seed phrases, private keys, and addresses - fundamental elements for cryptocurrency users.

- **Content:** This lesson demystifies the relationship between seed phrases, private keys, and addresses, explaining how they work together to secure your cryptocurrency holdings.

Key objectives and learning outcomes:

The course “Basic Blockchain Skills” aims to provide students with a comprehensive understanding of blockchain technology and its fundamental concepts. By the end of the course, students are expected to acquire the following skills and knowledge:

- Understanding of practical aspects of hash function.
- Understanding the connection of blocks in a blockchain using hashing algorithms.
- Understanding of Nonce.
- Understanding how to work with a block explorer.
- Understanding of UTXO transaction model.
- Understanding the connection between Seed phrase - Private key - Address.

The curriculum of this course is designed to equip students with a comprehensive understanding of key concepts essential for navigating this field. Key learning outcomes include:

- Understanding of Hashing Functions (SHA-256, Keccak): Students will be able to explain the concept of hashing functions and their practical applications in blockchain technology.
- Blockchain Structure: Students will be able to describe how hashing algorithms link blocks together within a blockchain.
- The Role of Nonces: Students will be able to explain the concept of Nonces and their significance in securing blockchain transactions.
- Utilizing Block Explorers: Students will be able to demonstrate the use of block explorers for navigating the blockchain network.
- UTXO Transaction Model: Students will be able to explain the UTXO (Unspent Transaction Output) transaction model.
- Seed Phrase, Private Key, and Address: Students will be able to explain the connection between seed phrases, private keys, and addresses, demonstrating a grasp of blockchain security and user identity.

Theoretical and experiential approaches to be adopted in the course:

This course adopts a blended learning approach, combining theoretical underpinnings with practical exercises to solidify understanding and equip learners with the skills to navigate the world of blockchain.

Theoretical Approaches:

- **Constructivism:** Learners actively construct their knowledge by building upon their existing understanding. The lesson will introduce the concept of hash functions in a clear and concise manner, allowing learners to connect this new information to their existing knowledge of computers and data.
- **Behaviourism:** Learning is reinforced through positive experiences. The hands-on exercises using online hash function tools will provide learners with the opportunity to practice using hash functions themselves, solidifying their understanding through active engagement.

- Social Cognitive Theory: Learning can be influenced by observing others and their experiences. The lesson can incorporate brief examples of real-world applications of hash functions (e.g., password storage) to demonstrate their practical value and stimulate learners' interest.

Experiential Approaches:

- Interactive Activities: The course incorporates interactive activities like quizzes and polls to gauge understanding and foster engagement. Additionally, instructors will encourage open discussions and debates to solidify concepts and encourage learners to think critically about the material.
- Hands-on Labs: The course will provide hands-on labs to equip learners with practical skills. These labs might involve using real block explorers to navigate the blockchain and analyse transactions. Learners might also engage in simulated exercises to practice applying their knowledge of UTXO models and secure key management practices.

Tools and methods to be provided on the course:

This course will employ a variety of tools and methods to create a comprehensive and engaging learning experience:

- Engaging Content Delivery:
 - Course Presentations: Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
 - Formative Assessments (Questions): Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
 - Interactive Resources: Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
 - Recommended Readings: To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- Assessment and Feedback:
 - Summative Assessments (Quizzes): At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.

4.2.8 Course 8 - Advanced Blockchain Skills

This course (*developed by 482.solutions*) provides learners with an in-depth understanding of advanced blockchain concepts and their real-world applications. Students will delve into the complex architectures that underpin blockchain technology and explore different types of crypto wallets, including distinctions between custodial and non-custodial wallets, and the uses of hot versus cold storage, including hardware wallets. The curriculum also introduces test nets and test net faucets, which allow for secure experimentation within blockchain environments. Additionally, participants will gain practical experience by creating tokens on the Ethereum test net using the Remix IDE and learn about smart contract basics. Lastly, the course covers the essentials of multi-signature transactions, employing tools like Gnosis Safe to enhance transaction security. This educational experience aims to provide both comprehensive theoretical knowledge and valuable practical skills in blockchain technology.

Course structure:

Building upon the foundational knowledge acquired in Course #7: Basic Blockchain Skills, this course delves into advanced concepts and functionalities of blockchain technology. Each lesson progressively equips you with the expertise to navigate the complexities of blockchain and explore its cutting-edge applications. Table 10 presents the design of Course #8.

Table 10: Design of Course #8

Lesson	Lesson Title	Course Duration
1	Crypto Wallets	Approximately 4 hours
2	Blockchain Test Nets	
3	Test Net Faucets	
4	Smart Contracts	
5	Multi-Signature Transactions	
6	Security Considerations	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Crypto Wallets

- **Objectives:** Understand the role of crypto wallets and their functionalities within the blockchain ecosystem.
- **Content:** This lesson explores crypto wallets, custodial vs non-custodial, hot vs cold storage options, and best practices for secure wallet management.

Lesson 2: Blockchain Test Nets

- **Objectives:** Grasp the concept of test nets and their significance in blockchain development.
- **Content:** We'll explore the concept of test nets in blockchain development and delve into popular test net options.

Lesson 3: Test Net Faucets

- **Objectives:** Understand the role of test net faucets and how to acquire testnet tokens.
- **Content:** This lesson introduces test net faucets and offers a video demonstration on how to use them to acquire testnet tokens.

Lesson 4: Smart Contracts

- **Objectives:** Gain a foundational understanding of smart contracts and their applications within blockchain technology.
- **Content:** We'll explore smart contracts, their significance, introduce Solidity programming, and provide a video demonstration on token creation and deployment on an Ethereum test net using Remix IDE.

Lesson 5: Multi-Signature Transactions

- **Objectives:** Explore the concept of multi-signature transactions and their benefits for security.
- **Content:** This lesson dives into multi-signature transactions, introduces Gnosis Safe as a popular solution, and offers hands-on exercises for creating and executing them.

Lesson 6: Security Considerations

- **Objectives:** Identify common security vulnerabilities in blockchain applications and learn best practices for mitigation.
- **Content:** We'll address common security vulnerabilities, explore best practices for protecting wallets, smart contracts, and transactions, and introduce auditing tools for increased security.

Key objectives and learning outcomes:

The course "Advanced Blockchain Skills" aims to provide students with a comprehensive understanding of blockchain technology and its fundamental concepts. By the end of the course, students are expected to acquire the following skills and knowledge:

- Understanding of advanced blockchain concepts and architectures.
- Understanding of crypto wallets and their types (custodial, not custodial, hot, cold, hardware)
- Understanding of test nets
- Understanding of test net faucets
- Basic understanding of smart contracts
- Basic understanding of multi signature transactions (Gnosis Safe)

By the end of the course, students are expected to develop a deep understanding of advanced blockchain concepts and architectures. They will learn about the various types of crypto wallets, including custodial, non-custodial, hot, cold, and hardware wallets. The course also covers the role and use of test nets, along with test net faucets, providing a safe environment for exploring blockchain technologies. Additionally, students will gain a basic understanding of smart contracts and delve into the specifics of multi-signature

transactions, including how to use tools like Gnosis Safe. This curriculum is designed to equip students with both theoretical insights and practical skills essential for mastering blockchain technology.

Theoretical and experiential approaches to be adopted in the course:

This course adopts a blended learning approach, combining theoretical underpinnings with practical exercises to solidify understanding and equip learners with the skills to navigate the world of blockchain.

Theoretical approach:

- Clear Explanations: Each lesson starts with clear definitions and in-depth explanations of key blockchain concepts.
- Solid Base: Readings, presentations, will solidify students' understanding of core principles and functionalities.

Experiential Approach:

- Testing Students' Knowledge: Interactive exercises and quizzes will challenge students to apply their understanding of the learned material.
- Real-World Applications: Case studies will expose students to real-world applications of blockchain technology across diverse industries.

Tools and methods to be provided on the course:

This course will employ a variety of tools and methods to create a comprehensive and engaging learning experience for all participants:

- Engaging Content Delivery:
 - Course Presentations: Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
 - Formative Assessments (Questions): Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- Enriching Resources:
 - Interactive Resources: Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
 - Recommended Readings: To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- Assessment and Feedback:

- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.

4.2.9 Course 9 - Areas of application for Blockchain Technology

Course #9 (developed by UNIC) offers an in-depth exploration of how blockchain technology can revolutionise various sectors of the agriculture and food industries. This beginner-level course is designed for professionals across all sectors interested in understanding the potential of blockchain to enhance transparency, efficiency, and sustainability in agri-food systems. Through detailed examples, learners will discover the practical benefits and face the challenges of implementing blockchain technology from farm to table.

Course structure:

This course is carefully designed to guide learners through the diverse applications of blockchain across the agri-food industry. Each lesson focuses on a specific sector, demonstrating how blockchain technology can solve prevalent issues and optimise processes. Table 11, present the design of Course #9

Table 11: Design of Course #9

Lesson	Lesson Title	Course Duration
1	Blockchain in Farming and Agriculture	Approximately 5 hours
2	Blockchain in Food Supply Chain	
3	Blockchain in Seafood and Fisheries	
4	Blockchain in Food Safety and Quality Assurance	
5	Blockchain in Fair Trade and Organic Certification	
6	Blockchain and Sustainable Agriculture	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Blockchain in Farming and Agriculture

- **Objective:** Gain a comprehensive understanding of blockchain's role in improving transparency and traceability in agricultural practices and explore the implementation and impact of smart contracts in farming for equitable compensation.
- **Content:** Enhancing traceability and transparency in crop production, use of smart contracts for fair farmer compensation.

Lesson 2: Blockchain in Food Supply Chain

- **Objective:** Analyse the impact of blockchain on the traceability and transparency of food supply chains and evaluate the efficiency improvements brought about by blockchain in these systems.

- **Content:** Comprehensive analysis of how blockchain enhances traceability, transparency, and efficiency within food supply chains.

Lesson 3: Blockchain in Seafood and Fisheries

- **Objective:** Examine how blockchain technology is being used to combat illegal fishing and enhance sustainability in the seafood industry.
- **Content:** Strategies for combating illegal fishing and enhancing sustainability through blockchain.

Lesson 4: Blockchain in Food Safety and Quality Assurance

- **Objective:** Understand blockchain's application in traceability and verification within the food supply chain and examine how blockchain technology ensures quality and safety from production to consumption.
- **Content:** Application of blockchain in tracking and verifying food safety and assuring quality from farm to table.

Lesson 5: Blockchain in Fair Trade and Organic Certification

- **Objective:** Learn how blockchain technology can authenticate fair trade and organic product claims and maintain the credibility of these certifications.
- **Content:** Ensuring authenticity of fair trade and organic claims through blockchain technology.

Lesson 6: Blockchain and Sustainable Agriculture

- **Objective:** Explore the potential of blockchain in facilitating sustainable agricultural practices and understand how blockchain can be used in carbon credit trading and environmental sustainability.
- **Content:** The role of blockchain in facilitating sustainable farming practices and carbon trading.

Key objectives and learning outcomes:

In this section, learners will grasp the course objectives, which include understanding the applications of blockchain in the agri-food industry and analysing the technology's benefits and challenges across different sectors. By the end of this course, participants will be able to:

- Understand the various applications of blockchain technology within the Agri-Food industry.
- Analyse the benefits and challenges of utilizing blockchain across various sectors of the Agri-Food industry.

Upon completing this course, participants will have a comprehensive understanding of how blockchain technology can be applied across various sectors of the agri-food industry. They will learn about the innovative uses of blockchain in enhancing traceability in crop production, ensuring fair compensation through smart contracts, and promoting sustainability in seafood and fisheries. Additionally, learners will explore the application of blockchain in food safety, quality assurance, and the certification of fair trade and

organic products. The course will also cover how blockchain can support sustainable agricultural practices and carbon trading, equipping learners with the knowledge to advocate for and implement blockchain solutions in their respective fields.

Theoretical and experiential approaches to be adopted in the course:

The course blends theoretical knowledge with practical real-world applications, providing learners with a solid understanding of how blockchain can be utilised effectively in the agri-food sector.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. These theoretical frameworks guide both the content delivery and the interactive elements of the course, aligning with the objectives of fostering understanding, practical application, and personal growth. The theoretical approach of this course provides a foundation for understanding the basic principles of blockchain technology and its specific applications in the agri-food industry. Through a series of structured lessons, learners will delve into how blockchain can transform traditional practices in agriculture and food supply chains, enhancing everything from farm management to consumer trust. The course emphasises the practical benefits of blockchain, such as increased transparency and efficiency, while also addressing the technological and regulatory challenges faced during implementation.

Experiential Approaches:

Under this course, learners will engage with real-world scenarios and case studies to see firsthand how blockchain implementations can drive improvements and address challenges in the agri-food industry.

- **Interactive Questions/Debate:** Engaging learners with interactive questions and fostering debates during live sessions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

A diverse array of educational tools will enhance the learning experience. This includes detailed presentations, interactive resources, and videos that enrich understanding. Quizzes and discussions will also be employed to encourage engagement and deepen comprehension of the material presented.

- **Course Presentations:** Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not

only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.

- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.10 Course 10 - Smart Contracts with Example Applications in Food Supply Chain

Course #10 (*developed by REZOS*) serves as a comprehensive exploration into the practical applications of smart contracts within the context of the food supply chain. Spanning approximately 8.5 hours, this advanced-level course is meticulously structured to provide participants, particularly SME owners, managers, and employees in the Food Supply Chain (FSC), with the advanced knowledge and practical skills necessary to leverage blockchain technology and smart contracts effectively. Tailored for a diverse audience with a focus on SMEs and a prerequisite of a bachelor's degree or equivalent, this course offers a structured curriculum and hands-on learning experience. Participants will gradually acquire the expertise needed to understand, evaluate, and potentially contribute to the implementation of smart contracts in the food supply chain. By the conclusion of the course, participants will be equipped with the advanced knowledge and skills to harness the efficiency, transparency, and reliability offered by smart contracts. They will be empowered to navigate challenges and exploit opportunities within the food supply chain industry, thereby contributing to its advancement and fostering sustainability.

Course structure:

This course is structured into nine comprehensive lessons, meticulously designed to explore the intricate world of smart contracts within the context of the food supply chain. With a total duration of approximately 8.5 hours, each lesson, spanning between 35 to 55 minutes, delves into specific topics, ranging from understanding the foundational principles of smart contracts and blockchain technology to practical applications and deployment strategies. The course format facilitates self-paced online learning, supplemented with interactive activities such as quizzes, case studies, and video tutorials, ensuring optimal engagement and comprehension. Participants will benefit from real-world examples and case studies, empowering them to grasp the transformative potential of smart contracts in revolutionising food industry

operations. Through this immersive learning experience, participants will not only enhance their theoretical knowledge but also acquire practical skills applicable to real-world scenarios within the food supply chain. Table 12 presents the design of Course #10.

Table 12: Design of Course #10

Lesson	Lesson Title	Course Duration
1	Introduction to Blockchain and Smart Contracts	Approximately 8.5 hours
2	Types of Smart Contracts	
3	Introduction to applications with smart contracts in food supply chain	
4	Use Cases of Smart Contracts in Food Supply Chain	
5	Benefits & Potential challenges of smart contracts	
6	Intro to Smart Contract Development	
7	The structure of a Solidity file	
8	Designing and Writing Smart Contracts	
9	Deploying and Testing Smart Contracts	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to Blockchain and Smart Contracts

- **Objective:** Define blockchain technology and explore its fundamental characteristics, including decentralisation, immutability, and transparency. Understand the practical applications of blockchain technology. Explore smart contracts and their historical development.
- **Content:** This lesson explores blockchain technology's fundamental concepts, real-world applications, and smart contract platforms, focusing on data integrity, security, supply chain management, voting systems, and digital identity verification.

Lesson 2: Types of Smart Contracts

- **Objective:** Explore the various types of smart contracts designed to face specific challenges within the food supply chain, while understanding their practical applications and benefits across various sectors, including payment, legal processes, governance, supply chain management, identification, insurance, tokenization, NFTs, cross-chain interactions, and the Internet of Things (IoT).
- **Content/Learning Outcomes:** Upon completing this lesson, participants will be able to evaluate the benefits and potential risks of implementing smart contracts within the food supply chain, recognise the transformative potential of blockchain technology in streamlining supply chain processes, appreciate the role of smart contracts in fostering innovation and efficiency within the food industry, and identify and differentiate various types of smart contracts and their applications within the food supply chain.

Lesson 3: Introduction to applications with smart contracts in food supply chain

- **Objective:** Explore how blockchain technology and smart contracts revolutionise food supply chains by evaluating their potential impact on efficiency, safety, and automation within the industry. Discover the various applications of smart contracts, including mitigating human error in payment processing, strengthening financial aspects of supply chain operations, and reducing food waste.
- **Content/Learning Outcomes:** Understand the fundamental concepts of smart contracts and blockchain technology and assess their potential applications in enhancing food supply chain processes. Identify implementation scenarios, evaluate the impact of smart contracts on food safety and supply chain efficiency, and comprehend their role in automating specific aspects of the food supply chain.

Lesson 4: Use Cases of Smart Contracts in Food Supply Chain

- **Objective:** Examine real-world applications of smart contracts in various sectors of the food supply chain, understanding their impact and addressing sector-specific challenges. Recognize the integration processes involved in deploying blockchain technology, including defining information, enabling real-time supply monitoring, identifying supply chain actors, and developing smart contracts.
- **Content/Learning Outcomes:** Understand how blockchain technology enhances security, traceability, and transparency in the food supply chain, demonstrated through real-world examples. Appreciate the significance of digital identity and traceability in ensuring product authenticity and quality within the food supply chain. Understand how blockchain contributes to efficiency improvements and cost reduction in food supply chain operations.

Lesson 5: Benefits & Potential challenges of smart contracts

- **Objective:** Understand the fundamental benefits, legal implications, and potential challenges associated with the adoption of smart contracts in blockchain-based agreements across various industries.
- **Content/Learning Outcomes:** Examine the legal and regulatory implications of adopting blockchain and smart contract technology, including considerations related to intellectual property, liability, jurisdiction, and regulatory compliance. Identify potential challenges and barriers in the implementation of smart contracts, such as data privacy concerns, regulatory compliance, and jurisdictional issues. Analyse the permanence of smart contracts and its implications for error correction, as well as privacy concerns related to code visibility and data. Evaluate potential vulnerabilities in smart contracts and the importance of thorough auditing and careful development in mitigating risks.

Lesson 6: Intro to Smart Contract Development

- **Objective:** Explore the basics of Ethereum and smart contract development using Solidity, focusing on configuring the development environment, implementing and testing smart contracts, and understanding Ethereum Testnet/mainnet distinctions.

- **Content/Learning Outcomes:** Learn the fundamentals of Ethereum, including its role as a platform for secure online transactions. Gain proficiency in Solidity, the programming language used for creating smart contracts, and understand its importance in programming on the Ethereum platform. Understand the components of a Solidity contract, including state variables, functions, modifiers, events, errors, enum types, and struct types. Select and set up suitable development environments based on project requirements. Discover the concept of Decentralized Applications (DApps) and their diverse applications in finance, gaming, social media, and other sectors. Implement security best practices to ensure the reliability and safety of smart contracts. Differentiate between testing Ethereum on testnets and deploying on the live Ethereum mainnet, understanding their respective purposes and implications for real-world applications like finance.

Lesson 7: The structure of a Solidity file

- **Objective:** Gain proficiency in using SPDX license IDs for licensing and copyright purposes, implement pragma directives effectively, understand ABI and Encoder options, explore experimental features, comprehend the significance of import statements, and familiarize yourself with best practices for commenting in Solidity code.
- **Content/Learning Outcomes:** Understand SPDX (Software Package Data Exchange) and its role in Solidity files and apply SPDX license IDs for copyright and licensing purposes. Explain pragma directives and their purpose and implement version pragmas for compiler compatibility. Define ABI (Application Binary Interface) and its importance in smart contract communication and differentiate between pragma abicoder v1 and v2. Recognize the role of import statements, differentiate between global and specific symbol imports, and understand the Solidity compiler's virtual filesystem. Employ best practices for commenting in code to improve readability and maintainability.

Lesson 8: Designing and Writing Smart Contracts

- **Objective:** Gain a comprehensive understanding of the fundamental concepts and building blocks of smart contracts, learn design principles tailored to the needs of the food supply chain, and understand gas optimization techniques for cost-effective deployment.
- **Content/Learning Outcomes:** Understand Core Concepts: Grasp the fundamentals of blockchain technology and smart contracts. Learn best practices for designing smart contracts, with a focus on applications within the food supply chain. Optimize Gas Usage: Employ gas optimization techniques for economical and efficient deployment of smart contracts, including approaches such as the use of gas tokens, code size reduction, and minimizing storage needs.

Lesson 9: Deploying and Testing Smart Contracts

- **Objective:** Understand the significance of unit testing for smart contract development and learn how to write unit tests. Set up efficient testing environments and explore deployment practices. Comprehend the importance of integration testing in ensuring overall system functionality. Implement automated security analysis using tools and adhere to best practices for secure coding. Explore advanced deployment configurations using Hardhat.
- **Content/Learning Outcomes:** Participants will develop proficiency in unit testing, configure testing environments, deploy smart contracts on Ethereum, ensure correct state changes, conduct

integration testing, implement security measures, and gain a comprehensive understanding of the smart contract lifecycle.

Key objectives and learning outcomes.

Throughout this course, participants will explore the intersection of Smart Contracts and the Food Supply Chain, unravelling their fundamental principles, practical implementations, and transformative potential in reshaping supply chain dynamics. From grasping the basics of smart contract development to analysing real-world applications in food distribution, this course offers a comprehensive journey into leveraging technology for enhanced traceability, efficiency, and security in the food industry.

Course #10 objectives are as follows:

- **Introduction to Blockchain and Smart Contracts:** Participants will establish a foundational understanding of blockchain technology and smart contracts, exploring their role in revolutionising the food supply chain.
- **Types of Smart Contracts:** Participants will investigate various types of smart contracts tailored to address specific challenges encountered across different stages of the food supply chain.
- **Use Cases of Smart Contracts in Food Supply Chain:** Participants will analyse real-world applications of smart contracts in critical areas of the food industry, recognising their impact on efficiency, trust, and authenticity.
- **Benefits & Potential challenges of smart contracts:** Participants will assess the advantages and potential challenges associated with the adoption of smart contracts in the food supply chain, understanding legal implications and regulatory considerations.
- **Introduction to Smart Contract Development:** Participants will gain insight into smart contract development, exploring the basics of Solidity programming language and the design principles essential for building reliable and secure contracts.
- **The structure of a Solidity file:** Participants will delve into the structure of Solidity files, understanding key components like import statements, pragma directives, and ABI options critical for effective smart contract development.
- **Designing and Writing Smart Contracts:** Participants will learn the intricacies of designing and writing smart contracts, optimising gas usage and adhering to best practices for secure coding in the food supply chain context.
- **Deploying and Testing Smart Contracts:** Participants will master the deployment and testing of smart contracts, developing proficiency in unit testing, integration testing, and ensuring compliance with security measures throughout the contract lifecycle.

Upon completion of this course, participants will emerge equipped with a comprehensive understanding of smart contracts' role in transforming the food supply chain. With the ability to navigate complexities, identify challenges, and implement innovative solutions, participants will be empowered to drive efficiency, trust, and sustainability across food industry operations.

Theoretical and experiential approaches to be adopted in the course:

A balanced blend of theoretical and experiential approaches is essential to provide a comprehensive learning experience. Theoretical approaches serve as the foundation, offering learners an understanding of the fundamental concepts, principles, and mechanisms underlying blockchain technology and smart contracts. This includes exploring topics such as the decentralised nature of blockchain, consensus mechanisms like Proof of Work and Proof of Stake, and the transformative potential of smart contracts in various industries, particularly within the food supply chain.

On the other hand, experiential approaches play a crucial role in reinforcing theoretical knowledge through practical application and hands-on learning. This involves interactive activities, case studies, and real-world examples that allow learners to engage directly with smart contract development tools and platforms like Ethereum. By immersing themselves in practical exercises such as writing and deploying smart contracts, participants can deepen their understanding of the concepts introduced in the course and gain valuable experience in navigating the complexities of blockchain technology.

By integrating both theoretical and experiential approaches, this course aims to provide a complete learning experience. Participants will gain both, the foundational knowledge and practical skills, in order to harness the transformative potential of blockchain and smart contracts effectively, especially within the food supply chain.

Tools and methods to be provided on the course:

This course offers a range of interactive tools and methods to ensure participants gain a thorough understanding of smart contracts and their application in the food supply chain.

Specifically, participants can expect:

- **Course Presentations:** Each lesson includes comprehensive presentations covering fundamental concepts, practical applications, and real-world case studies related to smart contracts in the food supply chain.
- **Curated Resources:** Access to a curated list of articles, books, and academic papers will be provided, allowing participants to delve deeper into specific topics and broaden their understanding of smart contract technology.
- **Formative Assessments:** Participants will engage in formative assessments throughout the course, featuring questions designed to assess understanding and reinforce key concepts.
- **Quizzes:** The course includes nine carefully designed quizzes to reinforce learning and assess comprehension of key concepts.
- **External Videos:** Four selected external videos provide additional insights and guidance on core concepts and practical steps related to smart contracts in the food supply chain. Topics include understanding blockchain's impact on food supply chains, creating Ethereum smart contracts with Solidity, deploying smart contracts using Remix IDE, and coding Ethereum smart contracts. These videos aim to assist participants in understanding key concepts and navigating essential steps in smart contract development and deployment.

- **Additional Links:** Participants will receive additional links to relevant resources, websites, enabling further exploration beyond the course curriculum.

These interactive tools aim to enhance participant engagement, foster critical thinking, and deepen understanding, ensuring a dynamic and enriching learning experience in this smart contracts' course.

4.2.11 Course 11 - Blockchain platforms

Course 11 (*developed by UNIC*) is a course designed to introduce professionals across various sectors to the diverse landscape of blockchain platforms and their applications within the food supply chain. This intermediate-level course guides learners through the key features, strengths, and limitations of major blockchain platforms such as Ethereum, Hyperledger, IBM Food Trust, VeChain, and others, providing them with a deep understanding of how these platforms can optimise and revolutionise food supply chain operations.

Course structure:

This course is meticulously designed to explore a variety of blockchain platforms, each with unique capabilities and specific relevance to the food supply chain. It starts with a general introduction and progresses through detailed analyses of individual platforms, resulting in a comparative evaluation to help learners assess and choose suitable technologies for their needs. Table 13 presents the design of Course #11.

Table 13: Design of Course #11

Lesson	Lesson Title	Course Duration
1	Introduction to Blockchain Platforms	Approximately 9 hours
2	Exploration of Key Blockchain Platforms – Part I (Ethereum)	
3	Exploration of Key Blockchain Platforms – Part II (Hyperledger Fabric)	
4	Exploration of Key Blockchain Platforms – Part III (IBM Food Trust)	
5	Exploration of Key Blockchain Platforms – Part IV (VeChain)	
6	Exploration of Key Blockchain Platforms – Part V (Tezos)	
7	Exploration of Key Blockchain Platforms – Part VI (NEAR)	
8	Exploration of Key Blockchain Platforms – Part VII (Polkadot)	
9	Exploration of Key Blockchain Platforms – Part VIII (Solana)	
10	Comparison of Blockchain Platforms	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to Blockchain Platforms

- **Objective:** Familiarize with different blockchain platforms and their application in the food supply chain.
- **Content:** Overview of the types and purposes of different platforms relevant to the food supply chain.

Lesson 2: Exploration of Key Blockchain Platforms – Part I (Ethereum)

- **Objective:** Understand the functionalities and versatility of the Ethereum platform.
- **Content:** Ethereum: Understanding smart contracts, decentralised apps (dApps), and the platform's overall versatility.

Lesson 3: Exploration of Key Blockchain Platforms – Part II (Hyperledger Fabric)

- **Objective:** Explore the advantages of Hyperledger Fabric as a private, permissioned blockchain.
- **Content:** Hyperledger Fabric: Discussing the advantages of private, permissioned blockchains and their uses in business and industry, with a specific focus on food supply chain applications.

Lesson 4: Exploration of Key Blockchain Platforms – Part III (IBM Food Trust)

- **Objective:** Study IBM Food Trust as a blockchain solution for the food supply chain.
- **Content:** IBM Food Trust: A study of this blockchain solution specifically designed for the food supply chain.

Lesson 5: Exploration of Key Blockchain Platforms – Part IV (VeChain)

- **Objective:** Learn about VeChain's specialisation in supply chain and logistics.
- **Content:** VeChain: Learning about this platform's focus on supply chain and logistics.

Lesson 6: Exploration of Key Blockchain Platforms – Part V (Tezos)

- **Objective:** Discuss Tezos and its application in agricultural insurance and the food supply chain.
- **Content:** Tezos: Discussing its use in agricultural insurance and how its features can benefit the food supply chain.

Lesson 7: Exploration of Key Blockchain Platforms – Part VI (NEAR)

- **Objective:** Understanding the scalable architecture of NEAR Protocol.
- **Content:** NEAR: Understanding its scalable blockchain platform design, developer-friendly interface, and potential applications in the food supply chain.

Lesson 8: Exploration of Key Blockchain Platforms – Part VII (Polkadot)

- **Objective:** Examine the interoperability of Polkadot and the functions of sidechains.
- **Content:** Polkadot: Exploring its interoperability across multiple blockchains, the role of sidechains, and potential use-cases in the food supply chain.

Lesson 9: Exploration of Key Blockchain Platforms – Part VIII (Solana)

- **Objective:** To understand and discuss Solana's high-speed and capacity capabilities.
- **Content:** Solana: Discussing its high-speed and high-capacity capabilities, how it achieves this, and what this could mean for large-scale, real-time applications in the food supply chain.

Lesson 10: Comparison of Blockchain Platforms

- **Objective:** Compare and discuss key factors like security, scalability, and consensus mechanisms across blockchain platforms.

- **Content:** Discussing factors such as security, scalability, consensus mechanisms, and smart contract functionality, and their relevance to the food supply chain.

Key objectives and learning outcome:

This section outlines the primary goals of the course, which include understanding the variety of blockchain platforms available, learning about their specific applications and limitations, and applying this knowledge to enhance decision-making processes within the food supply chain. By the end of this course, participants will be able to:

- Understand the landscape of different blockchain platforms.
- Learn the strengths, limitations, and use-cases for major blockchain platforms within the context of the Agri-Food industry.

Upon completing this course, participants will have a detailed understanding of the key blockchain platforms that influence the food supply chain sector. They will be equipped to identify the strengths and weaknesses of platforms like Ethereum, Hyperledger, IBM Food Trust, VeChain, Tezos, NEAR, Polkadot, and Solana, understanding their specific applications and potential benefits for food safety, traceability, and efficiency. Learners will also be capable of critically comparing these platforms based on factors like security, scalability, consensus mechanisms, and smart contract functionality, enabling them to make informed decisions on which platform best suits their needs in the food supply chain.

Theoretical and experiential approaches to be adopted in the course:

The course blends theoretical explanations with case studies and practical applications, providing learners with a robust understanding of how different blockchain platforms can be leveraged within the agri-food sector.

Theoretical Approaches:

The theoretical framework of Course #11, is centered around an in-depth analysis of various blockchain platforms and their technical and operational characteristics. The course begins with foundational knowledge about what blockchain is and how it functions, setting the stage for a deeper exploration of individual platforms. Each lesson is dedicated to one or several blockchain platforms, discussing their architecture, consensus mechanisms, and specific features like smart contracts and dApps (decentralized applications). As learners will progress through the course, they will explore how these platforms are tailored to meet the unique needs of the food supply chain, from enhancing traceability and transparency to facilitating secure and efficient transactions. This approach not only helps learners understand the theoretical underpinnings of each blockchain platform but also provides them with the analytical tools to assess their applicability and potential benefits in various contexts within the food supply chain.

Experiential Approaches:

Learners will engage with detailed case studies and practical examples that illustrate the real-world applications of blockchain platforms, enhancing their ability to apply theoretical knowledge to actual business challenges within the food supply chain.

- **Interactive Questions:** Engaging learners with interactive questions through the lessons. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

To facilitate a comprehensive learning experience, the course includes detailed presentations, interactive resources such as relevant websites and videos, and a specially prepared comparison data sheet for the blockchain platforms discussed. These tools are designed to enhance understanding and provide learners with tangible resources they can apply in their professional roles.

- **Course Presentations:** Each lesson includes a detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.12 Course 12 - Blockchain and Traceability in Relation to Food Supply Chain Integrity

In this course (*developed by WU*), participants will familiarise themselves with the topic of food supply chain integrity, comprehend the traceability systems principles and their application in food supply chains, and get an understanding of the basic operating principles of blockchain technology and how they can support

traceability systems. Participants will gain insight into how to design and practically use blockchain-based traceability systems through concrete examples from the food sector.

Course structure:

The course comprises six lessons and covers the topics presented in Table 14. The first lesson focuses on the basics of food supply chain integrity, the second and third lessons on traceability in the food supply chain, and lessons four to six on blockchain-based traceability. Each lesson consists of a PowerPoint presentation, a formative assessment incorporated within the lesson and a quiz. Table 14 presents the design of Course #12.

Table 14: Design of Course #12

Lesson	Lesson Title	Total Course Duration (est.)
1	A holistic approach to food supply chain integrity	Approximately 4.5 hours
2	Principles of a traditional traceability system in the food supply chain	
3	Examples of traceability systems in different food sectors	
4	Blockchain principles	
5	Using blockchain principles in designing traceability systems	
6	Blockchain examples from the food sector: implementation benefits and challenges	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: A holistic approach to food supply chain integrity

- **Objective:** The overall aim of the lesson is to introduce the topic of food integrity and show the need for a traceability system in the food supply chain.
- **Content:** The lesson will address the following topics: The importance of assuring food integrity; Food integrity elements; Examples of food integrity elements; A holistic approach to food integrity; Food integrity versus food fraud; Example issues on food integrity elements; Traceability and food integrity interrelation

Lesson 2: Principles of a traditional traceability system in the food supply chain

- **Objective:** The overall aim of the lesson is to get an understanding of the principles of traceability systems in the food supply chain.
- **Content:** The lesson will address the following topics: Traceability in the food supply chain; Elements of a food traceability system; Designing a food traceability system; Common technologies in food traceability systems; Benefits of traceability systems in the food supply chain; Challenges in applying traceability systems in the food supply chain

Lesson 3: Examples of traceability systems in different food sectors

- **Objective:** The overall aim of this lesson is to enhance the understanding of common traceability applications in two food supply chains.

- **Content:** The lesson will address the following topics: Use of Radio Frequency Identification (RFID) in the design of a traceability system for the Parmigiano Reggiano cheese supply chain; Use of Quick Response (QR) codes in the design of a traceability system for the pork meat supply chain

Lesson 4: Blockchain principles

- **Objective:** The overall aim of the lesson is to get an understanding of the basic operating principles of blockchain technology
- **Content:** The lesson will address the following topics: What is blockchain?; Security principles of blockchain technology; Functionalities of blockchain; Operating principles of blockchain; Different blockchain architectures; Examples of blockchain usage.

Lesson 5: Using blockchain principles in designing traceability systems

- **Objective:** The overall aim of the lesson is to get an understanding of how blockchain functionalities make it eligible and valuable for use in traceability systems in the food supply chain and the basics of blockchain-based traceability system design.
- **Content:** The lesson will address the following topics: The main challenges and needs in food supply chain traceability; Blockchain functionalities that can support the food supply chain traceability; Design of a blockchain-based traceability system.

Lesson 6: Blockchain examples from the food sector: implementation benefits and challenges

- **Objective:** The overall aim of the lesson is to get an understanding of the design and practical use of blockchain-based traceability systems in the food sector.
- **Content:** The lesson addresses the following topics: Steps in designing a blockchain-based traceability system; Case study on blockchain-based traceability system in a fruit and vegetable supply chain; Case study on blockchain-based traceability in a meat supply chain; Implementation benefits and challenges of blockchain-based food traceability systems in the food sector

Key objectives and learning outcomes:

The objective of this course is to provide interested participants, with a particular focus on SME owners, managers, and employees in the food supply chain, the knowledge and practical skills necessary to understand and implement blockchain technology in traceability systems to support food supply chain integrity.

By the end of this course, participants will be able to:

- familiarise with the topic of food supply chain integrity;
- comprehend the traceability systems principles and their application in food supply chains;
- understand the basic operating principles of blockchain technology and how they can support traceability systems; and
- comprehend the design and practical use of blockchain-based traceability systems in the food sector.

Theoretical and experiential approaches to be adopted in the course:

Theoretical and experiential approaches have been considered in the design of this course. The experiential approaches are in line with the defined theoretical approaches as further elaborated on below.

Theoretical approaches:

In the design of this course, the learning theories of behaviorism and constructivism have been applied to ensure an engaging learning experience for the learners.

- Behaviorism: Learners are encouraged to reflect on their knowledge by making formative assessments and quizzes. Feedback is directly provided to reinforce learners' understanding.
- Constructivism: Learners are encouraged to actively construct knowledge by engaging with the course materials. Throughout the course, formative questions are provided in which learners are stimulated to actively connect with the learning material. Additional activities are provided for the trainer to let the learners actively engage with the course material by connecting the course content with real-life examples or having discussions with peers.

Experiential approaches:

In line with the learning theories behaviorism and constructivism, several activities are offered in this course.

- Interactive questions: Many interactive questions are provided throughout this course to engage the learners with the course materials, thereby aligning with the behaviorism learning theory.
- Case studies: Multiple case studies are used throughout this course to let learners engage with real-life examples. Additional activities are provided for the trainer to let the learners actively engage with some of the case studies, thereby aligning with the constructivism learning theory.

Tools and methods to be provided in the course:

Participants can follow the course online in their own time or offline in the presence of a trainer. In an online setting, course presentations and recommended readings are made available to the participants. When a trainer is involved, interactive questions, interactive activities and debate and feedback can be made available by the trainer, as described in the trainer handbook.

- Course presentation: Each lesson is supported by comprehensive presentations that outline key concepts, processes, and examples. These presentations are crafted to aid in the clarification of complex subjects and ensure that all participants have access to the same foundational knowledge.
- Recommended readings: A curated list of articles, books, and papers is provided for further exploration of specific topics. These readings are intended to deepen participants' understanding and extend their knowledge beyond the core course material.
- Interactive questions: During live sessions, questions are used to create engagement and foster a dynamic learning environment.
- Interactive activities: During live sessions, extra activities are provided to the trainer to further enhance learners' engagement.

- **Debate and feedback:** During the lessons, critical thinking is encouraged to deepen students' understanding of the course content. This method promotes the exchange of ideas, perspectives, and experiences, enriching the learning experience.

4.2.13 Course 13 - Blockchain Applications for Food Quality Assurance and Certification

This course was developed by AUA. Effective monitoring of the food supply chain plays a significant role in food quality assurance and certification, so that it can be ensured that companies comply with certification procedures, such as ISO 22000, Protected Designation of Origin (PDO), Protected Geographical Indication (PGI), Traditional Speciality Guaranteed (TSG), Organic Products, and Fairtrade. The application of blockchain technology in the food supply chain can help in this direction, so as to ensure that the products meet regulatory requirements. This course provides interested participants, with a focus on SMEs in the food supply chain, the knowledge and practical skills required to design, develop, test, assess, adapt, deploy and adopt blockchain-based solutions that improve transparency, traceability, and trust in the food supply chain of their interest.

Course structure:

The course is divided into six lessons with appropriate assessment quizzes, offering a step-by-step guide for the exploitation of blockchain applications in the food quality assurance and certification sector. Table 15 presents the design of Course #13.

Table 15: Design of Course 13

Lesson	Lesson Title	Course Duration
1	Introduction to Food Quality Assurance and Certification	4h and 45 min
2	Supply Chain and Blockchain Application for Food Quality Assurance and Certification	
3	Blockchain Application for Milk Quality Assurance and Certification	
4	Blockchain Application for Honey Quality Assurance and Certification	
5	Blockchain Application for Wine Quality Assurance and Certification	
6	Blockchain Application for Olive Oil Quality Assurance and Certification	

Lesson 1: Introduction to Food Quality Assurance and Certification

- **Objective:** Understand the notions of ensuring the safety and quality of food products, and familiarise with the certification processes, acknowledging their significance in verifying the quality of food products.
- **Content:** Focusing on the notions of food quality assurance and certification and clarifying that they are important aspects of the food industry with benefits for both food companies and consumers.

Lesson 2: Supply Chain and Blockchain Application for Food Quality Assurance and Certification

- **Objective:** Development of a thorough comprehension of blockchain technology as it concerns to the Food Supply Chain (FSC), emphasizing its significance in maintaining food quality standards and certification processes. Examination of the transformative effects of blockchain applications on enhancing transparency, traceability, and accountability within food supply chains. Additionally, a systematic approach to identifying stakeholders involved in the FSC is analysed.
- **Content:** Presents the transformative impact of blockchain applications on transparency, traceability, and accountability within FSC and offers a structured approach to identify and engage stakeholders, empowering participants to navigate FSC dynamics effectively.

Lesson 3: Blockchain Application for Milk Quality Assurance and Certification

- **Objective:** Familiarisation with how blockchain technology contributes to ensuring the quality and certification of milk. The milk SC is analysed, examining participant roles, interactions, and potential quality challenges that might arise at various stages of the SC.
- **Content:** A step-by-step process to identify stages and stakeholders in milk SC is followed to understand the blockchain technology within milk SC to ensure milk quality and certification.

Lesson 4: Blockchain Application for Honey Quality Assurance and Certification

- **Objective:** Applying blockchain technology to ensure the quality and certification of honey through the thorough analysis of its examining participant roles, interactions, and potential quality challenges.
- **Content:** Following a step-by-step process to identify stages and stakeholders within the honey SC, with a focus on comprehending blockchain technology's application to ensure quality and certification that supports blockchain technology adoption to enhance transparency and accountability.

Lesson 5: Blockchain Application for Wine Quality Assurance and Certification

- **Objective:** Utilizing blockchain technology to ensure the quality and certification of wine involves a comprehensive analysis of participant roles, interactions, and potential quality challenges. This process entails examining the various actors involved in the wine production and distribution chain, as well as understanding how they interact and contribute to quality assurance. By leveraging blockchain, stakeholders can enhance transparency and traceability, mitigating quality challenges and ultimately improving the integrity of wine certification processes.
- **Content:** Employment of a systematic approach that guides through identifying the stages and stakeholders within the wine SC. The emphasis lies in understanding how blockchain technology can be applied to ensure quality and certification. By comprehending blockchain's role in enhancing transparency and accountability, participants are better equipped to support its adoption within the wine industry.

Lesson 6: Blockchain Application for Olive Oil Quality Assurance and Certification

- **Objective:** Exploring the role of blockchain technology in maintaining the quality and certification standards of olive oil. Examining participant roles, interactions, and potential quality challenges across different stages. This analysis provides a comprehensive understanding of how blockchain can effectively address transparency and accountability issues within the olive oil industry, ultimately ensuring the integrity of its products.
- **Content:** Application of blockchain technology within the olive oil SC for the assurance of quality and certification through a step-by-step process to identify the various stages and stakeholders involved, facilitating a comprehensive understanding of how blockchain enhances quality control and certification processes.

Key objectives and learning outcomes:

The course is designed with clear key objectives and specific learning outcomes to guide trainees through a structured learning path. Therefore, by the end of this course, participants will be able to:

- Understand the underlying processes and potential issues in food quality assurance and certification.
- Understand the benefits of blockchain adoption for food quality assurance and certification.
- Learn how blockchain technology can be used for food quality assurance and certification.
- Learn how to design and adapt their own blockchain application for food quality assurance and certification.
- Get familiar with and dive into specific case studies of blockchain application in food quality assurance (covering different food categories).

The following learning outcomes aim to provide not only theoretical knowledge but also practical skills that trainees can apply directly to their professional activities in food quality assurance and blockchain technologies:

- **Analyse Food Quality Assurance Processes:** Trainees will be able to explain the critical processes involved in food quality assurance and certification, identifying potential challenges and issues within these systems.
- **Evaluate the Impact of Blockchain on Food Quality Assurance:** Trainees will gain the ability to discuss the advantages of integrating blockchain technology into food quality assurance systems and articulate how this adoption can enhance transparency, traceability, and reliability in food certification.
- **Apply Blockchain Technology in Food Certification:** Trainees will learn practical skills in utilizing blockchain technology for enhancing food quality assurance and certification, including the development of foundational knowledge on blockchain functionality relevant to food systems.
- **Design Blockchain Solutions for Food Quality Assurance:** Trainees will be equipped to design and adapt blockchain-based applications specifically tailored for food quality assurance, considering the specific needs and constraints of their operation or context.

- Investigate Blockchain Case Studies in Food Assurance: Trainees will develop a comprehensive understanding of the application of blockchain technology across different food categories, enhancing their ability to critically analyse and apply these insights to real-world scenarios.

Theoretical and experiential approaches to be adopted in the course:

The course combines theoretical insights and real-world case studies and trainees will gain a deep understanding of how to adopt and apply blockchain solutions effectively within the food industry. The theoretical and experiential approaches are presented in detail here below.

Theoretical Approaches:

The course design is an integrative approach, blending behaviourism for foundational knowledge and constructivism for problem-solving. These theoretical frameworks shape both the content delivery and interactive components of the course, aimed at promoting understanding, practical application, and personal growth in alignment with the course objectives.

- Behaviourism Approach
 - Emphasis on Repetition and Practice: Behaviourism suggests that foundational knowledge is acquired through repetition and practice. Learners repeatedly engage with basic concepts or skills until they are firmly established. This approach emphasises drilling and rehearsal to reinforce foundational knowledge.
- Constructivism Approach
 - Active Engagement and Exploration: Constructivism emphasises active engagement in problem-solving tasks, where learners explore and manipulate information to construct their understanding. Problem-solving activities are designed to encourage learners to actively seek solutions, experiment with different approaches, and reflect on their experiences. This hands-on approach fosters critical thinking skills and promotes deeper understanding of problem-solving strategies.

Experiential Approaches:

- Case Studies: The course is based on the presentation of real-life examples – case studies that make clear the application of blockchain technology in specific FSC. This provides participants with appropriate skill that could be used in the FSC of their interest or field of work.

Tools and methods to be provided on the course:

The course combines diverse tools and methods to ensure an efficient and effective learning experience. More specifically, it uses presentations that incorporate additional reading material as well as quizzes for progress assessment as follows:

- **Course Presentation:** Each session is accompanied by comprehensive presentations focusing on blockchain applications in food quality assurance and certification. These presentations provide key concepts, processes, and real-world examples within the context of blockchain technology. They

serve to ensure that all participants gain access to a uniform foundational understanding of how blockchain enhances transparency and accountability in the FSC.

- **Recommended Readings:** A list of articles, books, and papers is provided for further exploration of specific topics. These readings are intended to deepen participants' understanding and extend their knowledge beyond the core course material.
- **Summative Assessments (Quizzes):** Short, regular quizzes have been designed to reinforce learning and ensure comprehension of key concepts.
- **Videos:** External YouTube videos as well as a demonstration video and a “Frequently Asked Questions” video will be supported under the scope of this course to further engage the learners.

4.2.14 Course 14 - ESG and SDGs in Food Supply Chain using Blockchain Technology

This course (*developed by 482.solutions*) dives deep into harnessing blockchain technology to promote Environmental, Social, and Governance (ESG) principles and Sustainable Development Goals (SDGs) within the food supply chain. You'll explore the fundamentals of ESG, SDGs, and their role in the food industry. We'll then analyse how blockchain empowers transparency, traceability, and compliance with these goals. Through real-world case studies, you'll gain practical knowledge of how blockchain is impacting the food supply chain. The course also explores the evolving regulatory landscape and its impact on ESG and SDG implementation. Finally, you'll delve into the impact on stakeholders and upcoming trends in blockchain technology for a sustainable food future.

Course structure:

Leveraging blockchain technology to create a more sustainable food system, this course explores how Environmental, Social, and Governance (ESG) principles and Sustainable Development Goals (SDGs) can be implemented within the food supply chain. You'll gain the knowledge and skills to navigate this exciting intersection of technology and social responsibility. Table 16 presents the design of Course #14.

Table 16: Design of Course #14

Lesson	Lesson Title	Course Duration
1	Introduction to ESG and SDGs	Approximately 8.5 hours
2	The Role of Blockchain in ESG and SDGs	
3	Institutional mechanisms surrounding ESG and SDGs in Food Supply Chain	
4	Practical case studies of Blockchain application for ESG and SDG	
5	Implications and Future Trends	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to ESG and SDGs

- **Objectives:** Grasp the core concepts of ESG and SDGs and their significance.
- **Content:** This lesson explores the importance of Environmental, Social, and Governance (ESG) factors in assessing a business's sustainability and ethical impact. It also discusses the Sustainable Development Goals and their relevance to the food supply chain, highlighting their impact on sustainability.

Lesson 2: The Role of Blockchain in ESG and SDGs

- **Objectives:** Explore how blockchain technology empowers ESG and SDG implementation in the food supply chain.
- **Content:** This lesson delves into how blockchain promotes traceability and transparency, enabling sustainable agricultural practices within the food supply chain.

Lesson 3: Institutional Mechanisms surrounding ESG and SDGs in Food Supply Chain

- **Objectives:** Understand the institutional mechanisms for integrating ESG and SDGs within the food supply chain using blockchain.
- **Content:** This lesson examines how blockchain can facilitate governance, coordination, partnerships, and data sharing for a more sustainable food value chain.

Lesson 4: Practical Case Studies of Blockchain application for ESG and SDG

- **Objectives:** Examine real-world examples of how blockchain applications are driving ESG and SDG goals.
- **Content:** We'll explore case studies showcasing how blockchain is used for fair trade, ethical sourcing, responsible consumption, and food waste reduction.

Lesson 5: Implications and Future Trends

- **Objectives:** Identify challenges and opportunities associated with implementing blockchain for ESG and SDGs in the food supply chain.
- **Content:** This lesson discusses the challenges of implementing blockchain and explores emerging trends shaping the future of a sustainable food system powered by blockchain technology.

Key objectives and learning outcomes:

This course aims to equip learners with the knowledge and skills to understand the application of Environmental, Social, and Governance (ESG) principles and Sustainable Development Goals (SDGs) within the food supply chain using blockchain technology.

Course Objectives:

- Equip learners with a foundational understanding of ESG, SDGs, and their relevance to the Food Supply Chain.
- Highlight the role of Blockchain technology in enhancing transparency, traceability, and compliance to ESG and SDGs in the Food Supply Chain.
- Provide practical case studies of Blockchain application for ESG and SDG monitoring, reporting and verification in real-world Food Supply Chain.

- Introduce the regulatory environment surrounding ESG and SDGs in Food Supply Chain and how Blockchain can aid in ensuring compliance.
- Prepare learners to understand the implications of implementing Blockchain for ESG and SDGs on various stakeholders and to anticipate future trends in this space.

The course is designed to equip students with a comprehensive understanding of various critical concepts that intersect technology and sustainability within the food supply chain. Students will learn to define and explain essential terms such as ESG (Environmental, Social, and Governance criteria), SDGs (Sustainable Development Goals), traceability, transparency, and blockchain technology. They will explore the relevance of ESG and SDGs specifically in the context of the food supply chain and understand how blockchain technology can enhance transparency and traceability to ensure more reliable food sourcing and distribution processes. Additionally, the role of blockchain in promoting sustainable agricultural practices will be covered, along with an analysis of the regulatory environment that impacts ESG and SDGs in the food supply chain. Students will engage in discussions about the benefits and challenges of implementing blockchain technology for monitoring ESG and SDG compliance in the food industry. Finally, the course will address emerging trends and potential future applications of blockchain technology for advancing ESG and SDGs in the food supply chain, preparing students to apply these insights in practical, innovative ways.

Theoretical and experiential approaches to be adopted in the course:

This course will explore the potential of blockchain technology to address environmental, social, and governance (ESG) challenges within the food supply chain, while aligning with Sustainable Development Goals (SDGs). The course will incorporate a variety of theoretical and experiential approaches to foster a comprehensive learning experience, drawing on the following learning theories:

Theoretical Approaches:

Constructivism: Active learning: Learners will actively construct their knowledge by building upon their existing understanding of food systems, sustainability, and potentially some basic technological concepts.

Real-world connections: Lectures and discussions will be interwoven with real-world examples of how ESG and SDGs intersect with the food supply chain, allowing learners to connect new information to their existing knowledge base.

Social Cognitive Theory: Observational learning: The course will showcase case studies where blockchain has been successfully implemented to address ESG/SDG challenges in the food industry. Observing these real-world applications can stimulate learners' interest and provide inspiration for potential future applications.

Collaborative learning: Group discussions and activities will encourage learners to share their perspectives and collaborate on exploring solutions to sustainability challenges in the food system using blockchain.

Connectivism: Networked learning: Learners will be encouraged to explore online resources beyond the course materials, such as industry reports, articles, and documentaries related to ESG, SDGs, and blockchain applications in the food sector. This will help them build connections between various knowledge sources and foster a broader understanding of the topic.

Knowledge sharing: Learners will have opportunities to share their findings and insights from external resources with the class, enriching the overall learning experience through collective knowledge exchange.

Experiential Approach:

- **Interactive questions:** Interactive exercises and quizzes will challenge students to apply their understanding of the learned material.
- **Case studies:** Case studies will expose students to real-world applications of blockchain technology across diverse industries.

Tools and methods to be provided on the course:

This course employs a variety of engaging methods to equip you with a comprehensive understanding of blockchain technology. Here's what you can expect:

- **Structured Learning:** Comprehensive Presentations: Each lesson is accompanied by detailed presentations outlining key concepts, processes, and real-world examples.
- **Curated Readings:** A curated list of articles, books, and papers will be offered for further exploration of specific topics, allowing students to delve deeper into the subject matter.
- **Interactive Engagement:** Interactive Questions: Live sessions will incorporate interactive questions to test students' knowledge, stimulate critical thinking, and foster a dynamic learning environment.

4.2.15 Course 15 - Climate Action, Energy transition and Blockchain in Food Supply chain

This course (*developed by 482.solutions*) empowers students to become active participants in creating a more sustainable food system. By exploring the intersection of Blockchain technology, climate action, and energy transition, students will gain the knowledge and skills to design and implement solutions for a responsible food supply chain. The course delves into the interconnectedness of these critical areas, highlighting how Blockchain can be a powerful tool for positive environmental impact.

Course structure:

This course empowers students to leverage Blockchain technology for a more sustainable future. Through a deep dive into the Climate-Energy-Food nexus, students will gain the knowledge and skills to design and implement Blockchain solutions that promote climate action, energy transition, and a responsible food supply chain. Table 17 presents the design of Course #15.

Table 17: Design of Course #15

Lesson	Lesson Title	Course Duration
1	Blockchain for Environmental Impact and Sustainability in the Food Supply Chain	Approximately 9 hours
2	Blockchain for Green Energy transition	
3	Blockchain for Life Cycle Assessment (LCA)	
4	Blockchain for Measurement, Reporting, and Verification (MRV)	

5	Sustainable Agriculture and Smart Farming Practices	
6	Environmental impact of Blockchain technology	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Blockchain for Environmental Impact and Sustainability in the Food Supply Chain

- **Objectives:** Understand how blockchain can revolutionize the food supply chain for greater sustainability.
- **Content** This lesson dives into the potential of blockchain to track food origin, reduce waste, and ensure responsible sourcing, contributing to a more environmentally friendly food system.

Lesson 2: Blockchain for Green Energy Transition

- **Objectives:** Learn the role of blockchain in facilitating a shift towards green energy sources.
- **Content** We'll explore how blockchain can facilitate peer-to-peer energy trading, improve grid management, and incentivize investment in green energy solutions.

Lesson 3: Blockchain for Life Cycle Assessment (LCA)

- **Objectives:** Explore how blockchain can enhance Life Cycle Assessment (LCA) practices.
- **Content** This lesson examines how blockchain can track environmental data throughout a product's lifecycle, leading to more sustainable practices across various industries.

Lesson 4: Blockchain for Measurement, Reporting, and Verification (MRV)

- **Objectives:** Learn how blockchain can improve Measurement, Reporting, and Verification (MRV) processes for environmental initiatives.
- **Content** We'll explore how blockchain can improve the credibility and efficiency of measuring, reporting, and verifying environmental impact data.

Lesson 5: Sustainable Agriculture and Smart Farming Practices

- **Objectives:** Explore the intersection of blockchain technology with sustainable agriculture and smart farming practices.
- **Content** This lesson dives into how blockchain can optimize resource management, promote ethical sourcing, and enable data-driven decision-making for sustainable farming practices.

Lesson 6: Environmental Impact of Blockchain Technology

- **Objectives:** Critically evaluate the environmental impact of blockchain technology itself.
- **Content** We'll discuss the energy consumption concerns surrounding blockchain and explore solutions for minimizing its environmental footprint.

Key objectives and learning outcomes:

This course equips students with the knowledge and skills to leverage Blockchain technology for a more sustainable food future.

Course Objectives:

- Understand the Climate-Energy-Food nexus.
- Master on how Blockchain can be a lever for climate action and energy transition in the food supply chain.
- To gain knowledge about the importance of sustainable agriculture in the context of climate change with the application of Blockchain technology"
- Acquire skills to design and implement Blockchain solutions in support of net-zero transition in Food Supply chain.

This course aims to provide students with a thorough understanding of the interrelatedness of climate, energy, and food systems—collectively referred to as the Climate-Energy-Food nexus—and its importance for sustainability. Students will delve into the role of sustainable agricultural practices in mitigating climate change and evaluate how blockchain technology can be leveraged to achieve net-zero emissions within the food supply chain. Additionally, the curriculum includes hands-on opportunities to design and propose blockchain-based solutions aimed at enhancing sustainability in the food sector. A critical assessment of the environmental impact of blockchain technology itself is also a key component of the learning outcomes. By the end of this course, students will be equipped with the knowledge and tools necessary to contribute effectively to creating a more sustainable food system through the strategic application of blockchain technology.

Theoretical and experiential approaches to be adopted in the course:

This course, "Climate Action, Energy Transition and Blockchain in Food Supply Chain," explores the potential of blockchain technology to address climate challenges and support a more sustainable food system. The course will integrate theoretical and experiential learning approaches, drawing on the following theories:

Constructivism: Active learning: Learners will actively construct their knowledge by building upon their existing understanding of climate change, energy systems, and potentially some basic knowledge of food production. Lectures and discussions will be designed to encourage learners to connect new information about blockchain technology to their existing understanding of these critical sustainability issues.

Real-world connections: The course will feature real-world case studies and examples of how blockchain is being used to promote climate action and energy transition within the food supply chain. These connections will help learners see the practical applications of blockchain technology in addressing sustainability challenges.

Behaviourism: Mastery-oriented learning: The course is designed to provide a sense of accomplishment as learners progress through the modules. By mastering key concepts related to the climate-energy-food nexus,

blockchain technology, and its applications, learners will be motivated to continue their exploration of these topics.

Immediate feedback: Quizzes and formative assessments throughout the course will provide learners with immediate feedback on their understanding. This feedback allows learners to identify areas where they need further study and reinforces key concepts.

Social Cognitive Theory: Observational learning: The course will showcase case studies where blockchain has been successfully implemented to address climate and energy challenges in the food industry. Observing these real-world applications can stimulate learners' interest and provide inspiration for potential future applications.

Collaborative learning: Group discussions and activities will encourage learners to share their perspectives and collaborate on exploring solutions to climate change and energy transition in the food system using blockchain.

Experiential Activities:

Case study analysis: Learners will actively analyse real-world case studies of how blockchain is being used to promote climate action and energy transition within the food supply chain.

4.2.16 Course 16 - Blockchain Adoption Strategies for Small and Medium-sized Enterprises in the Food Sector

Course #16 (*developed by UNIC*) is an insightful course tailored to empower SMEs within the food industry to harness the benefits of blockchain technology. This beginner-level course demystifies the process of blockchain adoption, exploring both its potential benefits and the hurdles SMEs may face. Through a series of structured lessons, participants will learn effective strategies for integrating blockchain technology into their operations to enhance traceability, improve compliance, and build consumer trust.

Course structure:

This course is designed to guide participants through the fundamentals of blockchain technology, the specific challenges it addresses in the food sector, and practical steps for its implementation. Each lesson builds progressively to cover essential aspects of blockchain adoption, from initial assessment to full deployment. Table 18 presents the design of Course #16.

Table 18: Design of Course #16

Lesson	Lesson Title	Course Duration
1	Understanding the potential of blockchain technology for SMEs in the food sector.	Approximately 3 hours
2	The challenges of blockchain adoption for SMEs in the food sector	
3	Key Steps in Blockchain Adoption for SMEs in the food sector	
4	Case Studies	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Understanding the Potential of Blockchain Technology for SMEs in the Food Sector

- **Objective:** Demystify blockchain technology and illustrate its practical applications in the food sector, such as enhancing traceability, reducing fraud, and building consumer trust.
- **Content:** The inherent features of blockchain like immutability, transparency, and traceability addressing key challenges including fraud, mislabelling, and compliance issues.

Lesson 2: The Challenges of Blockchain Adoption for SMEs in the Food Sector

- **Objective:** Analyse the hurdles SMEs face when considering blockchain adoption, from implementation stages to regulatory and technological constraints.
- **Content:** Limited resources, lack of technical expertise, integration complexities, cost implications, and regulatory compliance challenges, with a focus on data protection laws like GDPR.

Lesson 3: Key Steps in Blockchain Adoption for SMEs in the Food Sector

- **Objective:** Outline a roadmap for SMEs to adopt blockchain, covering needs assessment, stakeholder engagement, platform selection, implementation strategy, and staff training.
- **Content:** Integration challenges of Blockchain and IoT, needs assessment, stakeholder engagement, platform selection, implementation strategy, staff training, and change management.

Lesson 4: Case Studies

- **Objective:** Investigate and discuss real-world applications and case studies of blockchain and IoT implementations in the food supply chain.
- **Content:** Analysis of successful blockchain implementations by SMEs in the food sector, focusing on smart farming, efficient transportation, and the integration of emerging technologies.

Key objectives and learning outcomes:

This section clearly outlines what participants will learn throughout the course, including the understanding of blockchain's potential, recognizing adoption challenges, and mastering strategic planning for its implementation. By the end of this course, participants will be able to:

- Understand the potential benefits and challenges of blockchain adoption for SMEs in the food sector.
- Learn about strategies for successful blockchain adoption.
- Evaluate real-world examples of blockchain adoption in the food sector

Upon completing this course, participants will be well-equipped with the knowledge to assess the feasibility of blockchain technology for their business operations within the food sector. They will understand the specific benefits such as improved traceability and compliance with safety regulations and identify the challenges like cost and technical complexity that may impact adoption. Learners will also gain insights into strategic planning for blockchain implementation, including stakeholder engagement, platform selection, and effective project management. The course will prepare SMEs to navigate the complexities of adopting

blockchain technology, ensuring they are ready to make informed decisions and implement solutions that enhance operational efficiency and market competitiveness.

Theoretical and experiential approaches to be adopted in the course:

This course combines theoretical frameworks with practical examples to ensure participants understand both the 'why' and the 'how' of blockchain adoption in the SME context of the food sector.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. The theoretical foundation of this course covers a comprehensive overview of blockchain technology, focusing on its relevance to SMEs in the food sector. It begins with an introduction to the basics of blockchain technology, followed by detailed discussions on how it can solve specific problems faced by SMEs, such as enhancing transparency and ensuring product authenticity. The course also tackles the practical aspects of adopting blockchain, including the evaluation of platform features, understanding the infrastructure requirements, and strategic planning for implementation. This theoretical approach ensures that learners not only grasp the concepts but also understand how to apply them practically to reap maximum benefits.

Experiential Approaches:

Through practical case studies, participants will explore real-world examples of successful blockchain integration, helping them visualize potential applications and outcomes in their own businesses.

- **Interactive Questions/Debate:** Engaging learners with interactive questions and fostering debates during live sessions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

The course will utilize detailed and easy-to-understand slide presentations to break down the concepts of blockchain technology and its applications in the food sector. Interactive resources, including relevant websites and online videos, will be provided to supplement learning and offer real-time examples of blockchain technology in use. Additionally, recommended readings will be provided to deepen learners' understanding of the subject and support continued learning beyond the course framework.

- **Course Presentations:** Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not

only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.

- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.17 Course 17 - Ethical Considerations and Governance in Blockchain-enabled Food Supply Chains

Course #17 (*developed by UNIC*) critically explores the complex ethical landscape and governance structures necessary for the effective use of blockchain in the food supply chain. This advanced course is designed to equip professionals with the tools to analyse the social, environmental, and ethical ramifications of blockchain implementations and to navigate the regulatory environments influencing these technologies. Through detailed case studies and expert analysis, participants will learn to implement blockchain responsibly, ensuring transparency, equity, and sustainability in food supply chains.

Course structure:

The course is systematically structured to address both the theoretical underpinnings and practical applications of blockchain in ethical and governance contexts. Starting with an introduction to the technology's basic concepts, it progressively delves into specific ethical considerations, governance mechanisms, and the regulatory landscape affecting blockchain applications in the food sector.

Table 19 presents the design of Course #17.

Table 19: Design of Course #17

Lesson	Lesson Title	Course Duration
1	Introduction to Blockchain Technology in Food Supply Chains	Approximately 3 hours
2	Ethical Considerations and Transparency in Blockchain-enabled Supply Chains	
3	Governance and Decision-making in Blockchain-enabled Food Supply Chains	
4	Social and Environmental Impacts of Blockchain Implementation	
5	Regulatory Landscape for Blockchain in the Food Supply Chain and Future Directions	

**The total duration of the course has been calculated for participants who follow the course online in their own time. When a trainer is involved, it is estimated that the additional activities as described in the trainer handbook will add 15-30 minutes extra to each lesson.*

Lesson 1: Introduction to Blockchain Technology in Food Supply Chains

- **Objective:** Introduce blockchain technology's transformative effects and challenges in the food supply chain.
- **Content:** Overview of blockchain technology, including its potential advantages and key concepts of transparency, traceability, and trust within the food supply chain.

Lesson 2: Ethical Considerations and Transparency in Blockchain-enabled Supply Chains

- **Objective:** Explore blockchain's role in promoting ethical practices within supply chains.
- **Content:** Examination of blockchain technology's potential to support fair trade, organic labelling, animal welfare, and case studies demonstrating ethical outcomes.

Lesson 3: Governance and Decision-making in Blockchain-enabled Food Supply Chains

- **Objective:** Understand decision-making mechanisms in blockchain governance and the roles of different stakeholders.
- **Content:** Overview of governance models, stakeholder roles, decision-making processes, and regulatory considerations in blockchain systems.

Lesson 4: Social and Environmental Impacts of Blockchain Implementation

- **Objective:** Address the primary positive and negative impacts of blockchain on society and the environment.
- **Content:** Discussion on energy consumption, e-waste, and strategies for minimizing blockchain implementation's environmental impact.

Lesson 5: Regulatory Landscape for Blockchain in the Food Supply Chain and Future Directions

- **Objective:** Dive into current regulations, standards, and future directions for blockchain in the food supply chain.

- **Content:** Analysis of the regulatory environment, including MiCa and other relevant regulations, standards, and guidelines for blockchain applications in the food supply chain.

Key objectives and learning outcomes:

This section outlines the course's primary goals, including understanding the ethical challenges and governance requirements of blockchain technology in the food supply chain, and developing strategies to address these challenges effectively. By the end of this course, participants will be able to:

- Analyse the ethical ramifications of implementing blockchain technology in the food supply chain and recommend solutions to mitigate them.
- Evaluate the governance mechanisms necessary for the efficient deployment and administration of food supply chains enabled by blockchain technology.
- Evaluate the social and environmental consequences of blockchain technology in the context of food supply networks and provide mitigating strategies.
- Understand the current regulatory environment and identify potential and obstacles to blockchain use in the food business.

Upon completion of this course, participants will have a thorough understanding of the ethical considerations and governance mechanisms related to blockchain technology in the food supply chain. They will be able to critically analyse the potential benefits and challenges associated with blockchain adoption, with a particular focus on ensuring ethical integrity, social responsibility, and environmental sustainability. Furthermore, learners will gain insights into the current regulatory frameworks that govern blockchain use in the food industry and develop strategies to navigate these effectively, ensuring compliance while advocating for ethical practices.

Theoretical and experiential approaches to be adopted in the course:

The course combines rigorous theoretical exploration with practical, real-world applications, ensuring participants understand both the ethical implications and governance frameworks essential for blockchain integration in the food industry.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. These theoretical frameworks guide both the content delivery and the interactive elements of the course, aligning with the objectives of fostering understanding, practical application, and personal growth. In more detail, the theoretical approach of this course focuses on the ethical implications and governance requirements of using blockchain technology in the food supply chain. It examines how blockchain can support ethical objectives like fair trade and organic labelling, while also addressing potential drawbacks such as energy consumption and e-waste. Governance discussions will cover stakeholder roles, decision-making processes, and how to establish effective regulatory compliance. By blending theory with practical analysis, the course ensures a comprehensive understanding of how to responsibly implement blockchain technology in the food sector.

Experiential Approaches:

Participants will engage with practical scenarios and case studies that highlight the ethical and governance challenges faced by organizations implementing blockchain, fostering a deep understanding of how to navigate these issues effectively.

- **Interactive Questions:** Engaging learners with interactive questions and fostering debates during live sessions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

The course will utilise detailed presentations to clearly outline the ethical considerations, governance structures, and regulatory environments related to blockchain technology. Interactive resources, including relevant websites and online videos, will provide additional insights and contextual understanding. A glossary of key terms will help participants navigate the complex terminology associated with blockchain ethics and governance. To facilitate a deeper understanding and application of the concepts discussed, case studies and scenario analyses will be integral to the course, enabling learners to apply their knowledge in practical settings.

- **Course Presentations:** Each lesson includes detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.
- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in

illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.18 Course 18 - Combined Powers: Blockchain and Internet of Things in Transforming the Food Supply Chains

Course #18 (*developed by UNIC*) is an advanced course designed to explore the dynamic intersection of Blockchain and IoT technologies in enhancing food supply chain operations. This course aims to elucidate how the integration of these two technologies can lead to unprecedented improvements in traceability, efficiency, and waste reduction. Participants will delve into both the potentials and challenges of Blockchain and IoT applications in the food sector, examining real-world examples and contemplating future advancements in this exciting field.

Course structure:

This course is thoughtfully structured to guide learners through the complexities of Blockchain and IoT technologies, starting from their basic principles to more advanced discussions on their integration and application in the food supply chain. The curriculum progresses to address integration challenges, real-world case studies, and potential future trends. Table 20 presents the design of Course #18.

Table 20: Design of Course #18

Lesson	Lesson Title	Course Duration
1	Fundamentals of Blockchain and IoT	Approximately 2.5 hours
2	Combining Blockchain and IoT	
3	Blockchain and IoT Integration Challenges	
4	Case Studies & Future Developments	

Lesson 1: Fundamentals of Blockchain and IoT

- **Objective:** Grasp the basic principles and components of blockchain and IoT, and comprehend their significance in the food supply chain context.
- **Content:** Introduction to blockchain and IoT technologies, their roles, and impact on enhancing transparency, traceability, and efficiency in food supply chains.

Lesson 2: Combining Blockchain and IoT

- **Objective:** Explore the synergistic relationship between Blockchain and IoT through different integration models and use cases.
- **Content:** Discussion on the integration of Blockchain and IoT, complementing functionalities like real-time data collection by IoT and data integrity maintenance by Blockchain.

Lesson 3: Blockchain and IoT Integration Challenges

- **Objective:** Address the challenges faced when integrating Blockchain and IoT within the food supply chain, focusing on technical, economic, and organizational aspects.
- **Content:** Analysis of integration challenges and exploration of potential solutions to overcome these obstacles for successful implementation.

Lesson 4: Case Studies & Future Developments

- **Objective:** Investigate real-world applications and anticipate future trends, analysing case studies in smart farming and efficient transportation.
- **Content:** Examination of practical Blockchain and IoT applications within the food supply chain, including their integration with emerging technologies like AI, Machine Learning, and 5G. Discussion on anticipated future innovations and their potential impact on the food supply chain.

Key objectives and learning outcomes:

This section delineates the learning objectives for the course, focusing on understanding the roles of Blockchain and IoT, addressing the integration challenges, and evaluating the benefits and real-world applications of these technologies in the food industry. By the end of this course, participants will be able to:

- Understand the roles and synergies of Blockchain and the Internet of Things (IoT) in food supply chains.
- Understand the challenges of Blockchain and IoT integration within the food supply chain and find potential solutions.
- Examine how Blockchain and IoT may improve food supply chain efficiency, waste reduction, and traceability.
- Evaluate real-world examples of Blockchain and IoT applications in the food sector.
- Gain an understanding of the potential future trends and directions of Blockchain and IoT in the food industry.

Upon completing this course, participants will possess a deep understanding of how Blockchain and IoT technologies can be integrated to enhance various aspects of the food supply chain. They will have analysed the synergies between Blockchain's data integrity and transparency and IoT's real-time data collection capabilities. Learners will be able to identify and overcome the challenges involved in integrating these technologies and evaluate the effectiveness of existing applications in the food sector. Additionally, they will explore future directions and innovations that could further revolutionize food supply chain management, preparing them to lead initiatives in their respective organizations.

Theoretical and experiential approaches to be adopted in the course:

The course seamlessly merges theoretical knowledge with practical examples to ensure learners gain a comprehensive understanding of how Blockchain and IoT can be synergistically used to transform the food supply chain.

Theoretical Approaches:

The design of this course is underpinned by an integrative approach that combines Constructivism, Humanism, and Connectivism, ensuring a comprehensive and engaging learning experience. These theoretical frameworks guide both the content delivery and the interactive elements of the course, aligning with the objectives of fostering understanding, practical application, and personal growth. The theoretical approach of this course covers a comprehensive exploration of Blockchain and IoT technologies, focusing on their potential to transform the food supply chain. Lessons will detail the functional aspects of each technology, followed by discussions on their integration to optimize food supply chain processes such as traceability, efficiency, and compliance. Theoretical discussions are supplemented with practical examples and case studies, ensuring learners can visualize the application of these technologies and understand their impacts comprehensively.

Experiential Approaches:

Learners will engage with case studies and practical scenarios that demonstrate successful implementations of Blockchain and IoT in the food sector, fostering an understanding of how these technologies can be applied effectively. Specifically, the approaches provided are the following:

- **Interactive Questions:** Engaging learners with interactive questions. This approach creates a dynamic learning environment that encourages participation and deepens understanding through discussion.
- **Case Studies:** Participants engage in analysing case studies to apply and critically evaluate the knowledge acquired. This method aligns with Constructivist principles by integrating practical examples with theoretical learning, enhancing critical thinking and application skills.

Tools and methods to be provided on the course:

A variety of educational tools will support the learning objectives, including detailed presentations, interactive resources, and videos that enhance understanding and engagement. Discussions and analyses of real-world cases will be instrumental in illustrating the practical application of the concepts covered.

- **Course Presentations:** Each lesson includes a detailed presentations that meticulously outline key concepts, processes, and real-world examples. These presentations are essential for clarifying complex subjects and guaranteeing that all participants have access to consistent and foundational knowledge.
- **Interactive Resources:** Learners will have access to an extensive range of interactive resources, including relevant websites and meticulously curated online videos. These resources are chosen not only to complement the instructional content but also to enhance understanding by providing practical examples and broader contextual insights.
- **Recommended Readings:** To encourage further exploration and deeper understanding, participants will be provided with a curated list of articles, books, and academic papers. These readings delve into specific topics covered in the course, offering additional perspectives and extending knowledge beyond the immediate course materials.

- **Formative Assessments (Questions):** Throughout each lesson, strategically placed questions aim to engage students actively. These formative assessments are designed to stimulate thought and discussion, helping learners to digest and apply their knowledge incrementally.
- **Summative Assessments (Quizzes):** At the end of each lesson, quizzes serve as summative assessments to evaluate comprehension and retention of the material. These quizzes are integral to measuring the effectiveness of the learning process and ensuring that key points are understood.
- **Videos:** Each lesson incorporates a variety of video materials, including custom-made instructional videos and selected external videos from platforms like YouTube. These videos are instrumental in illustrating concepts visually and providing real-world applications of theoretical knowledge, making complex ideas more accessible and engaging.

4.2.19 Course 19 - Combined Powers: Blockchain and Artificial Intelligence in Transforming the Food Supply Chain

Course #19 (*developed by Rezos Brands*) serves as an exploration into the integration of Artificial Intelligence (AI) and Blockchain Technology in optimising the food supply chain. Spanning 3.5 hours, this course offers a structured overview of how AI and blockchain collaborate to enhance various aspects of food distribution. Tailored for a diverse audience with a prerequisite of a bachelor's degree or equivalent, this intermediate-level program offers a structured curriculum and advanced concepts empowering participants to navigate complex topics with depth and precision. By the end of the course, attendees will be adept at leveraging the transformative potential of AI and blockchain technologies to optimize supply chain operations and foster sustainability within the food sector.

Course structure:

This course is structured into a series of 5 engaging lessons, each developed to explore various aspects of the integration between Artificial Intelligence (AI) and blockchain technology in revolutionizing the food supply chain. Spanning a total duration of 3.5 hours, the course structure is thoughtfully tailored to optimize learning outcomes while ensuring participants' engagement and comprehension. Each lesson, ranging from 45 to 50 minutes, delves into specific topics, starting from understanding the foundational principles of AI and blockchain technology to exploring real-world applications and future trends in the food industry. The format of the course is designed to accommodate self-paced online learning, with additional time allocated for interactive activities such as quizzes, case studies, and videos. The course is enriched with practical case studies and real-world examples, allowing participants to deepen their understanding of AI and blockchain's transformative potential in the food supply chain. This interactive approach not only enhances the learning experience but also equips participants with insights and practical skills applicable to real-world scenarios. Table 21 presents the design of Course #19.

Table21: Design of Course 19

Lesson	Lesson Title	Course Duration
1	Introduction to Blockchain and AI	Approximately 3 hours and 30 minutes
2	Food Supply Chain Challenges	
3	Impact of blockchain and AI applications in Food Supply Chain	
4	Integrating AI with blockchain for Food Supply Chain Transformation	
5	Blockchain and AI Use Cases in food supply chain	

Lesson 1: Introduction to Blockchain and AI

- **Objective:** Understand the basics of Artificial Intelligence and Blockchain Technology. Explore the potential synergy between these two technologies and how AI can address the limitations of Blockchain.
- **Content:** This lesson explores the synergy between Artificial Intelligence (AI) and Blockchain Technology, highlighting their strengths and potential solutions. The fundamentals of AI, including its various categories and comparison to human intelligence, are introduced, followed by an overview of Blockchain Technology and smart contracts. The lesson also addresses the limitations of Blockchain, such as scalability and data privacy, and discusses how AI can overcome these challenges. Finally, the future direction of the AI-Blockchain synergy and its potential applications are explored.

Lesson 2: Food Supply Chain Challenges

- **Objective:** Know about the food supply chain and its five key stages: production, processing, distribution, retailing, and consumption. Identify and analyse challenges throughout the chain and categorize them into four different categories.
- **Content:** This lesson delves into the Food Supply Chain by breaking it down into five stages. Each stage is thoroughly explained to provide a clear understanding of the supply chain's structure. Additionally, the lesson categorizes and analyses the challenges encountered throughout the journey from farm to fork, focusing on four main categories: technical, security, funding, and privacy issues.

Lesson 3: Impact of blockchain and AI applications in Food Supply Chain

- **Objective:** Understand the potential of blockchain technology to improve efficiency in the food supply chain. Learn about the beneficial changes in the Food Supply Chain using AI and Blockchain technologies. Explore various blockchain and AI applications in the Food Supply Chain.
- **Content:** This lesson examines the optimized structure of the Food Supply Chain through the beneficial changes provided by blockchain technology solutions. The current applications of Artificial Intelligence and blockchain technology in the food supply chain are discussed to highlight their positive impact on the entire process. The lesson covers how AI and blockchain enhance security,

transparency, and traceability, ultimately improving efficiency, reducing costs, minimizing fraud, fostering food security, and enhancing customer trust.

Lesson 4: Integrating AI with blockchain for Food Supply Chain Transformation

- **Objective:** Explore the future directions of blockchain and AI in the Food Supply Chain. Examine future applications of the two technologies to ensure a safe, transparent, sustainable, and resilient food supply chain.
- **Content:** This lesson focuses on the future direction of integrating Artificial Intelligence (AI) and blockchain technology to optimize supply chain efficiency. As these technologies continue to evolve, their increased adoption across the food industry is expected to lead to a more sustainable, resilient, and trustworthy food system. The potential of this technological evolution is presented through various applications in fields such as tokenization, decentralized marketplaces, sustainability tracking, and food safety compliance.

Lesson 5: Blockchain and AI Use Cases in food supply chain

- **Objective:** Enhance traceability and efficiency through AI-driven smart contracts. Understand the impact of real-time decision-making with AI and blockchain. Review case studies of blockchain and AI applications in the food supply chain.
- **Content:** This lesson explores the results of integrating artificial intelligence technologies with smart contracts and how AI-driven smart contracts can enhance traceability and efficiency in the food supply chain. The benefits of predictive analysis and real-time decision-making with AI and blockchain are also examined. Finally, the lesson discusses real-world use cases and examples of these innovative technologies in action.

Key objectives and learning outcomes:

In this course, students will delve into the convergence of Artificial Intelligence (AI) and Blockchain Technology, exploring their fundamental concepts, practical applications, and future implications in transforming the food supply chain. From understanding the foundational principles of AI and blockchain to examining their collaborative potential in enhancing supply chain efficiency and traceability, this course offers a comprehensive exploration of cutting-edge technologies shaping the future of food systems.

Course's #19 objectives are the following:

- **Understanding blockchain fundamentals:** Participants will explore the foundational principles of blockchain technology and comprehend the diverse types of blockchains, such as public, private, and consortium. They will analyse the advantages and use cases of each type.
- **Analysing AI in the food supply chain:** Participants will examine the role of Artificial Intelligence (AI) in optimizing supply chain processes, from predictive analytics to real-time decision-making. They will also understand how AI-driven smart contracts enhance traceability and efficiency in the food supply chain.
- **Identifying challenges and solutions:** Participants will identify and analyse the challenges inherent in the food supply chain, including technical, security, funding, and privacy issues. They will explore

how AI and blockchain technologies offer innovative solutions to address these challenges and improve supply chain resilience.

- **Exploring future applications:** Participants will investigate future applications of AI and blockchain in ensuring a safe, transparent, sustainable, and resilient food supply chain. They will understand emerging trends such as tokenization, decentralized marketplaces, and sustainability tracking, and their potential impact on food systems.
- **Case studies and real-world examples:** Participants will examine real-world case studies of companies utilizing AI and blockchain technologies to optimize food supply chain operations. They will analyse successful implementations and best practices for leveraging these technologies effectively in the food industry.

Upon completing this course, students will emerge with a comprehensive understanding of the synergistic potential of AI and blockchain technologies in revolutionizing the food supply chain. Equipped with a deep understanding of these cutting-edge technologies, they will possess the knowledge and skills to identify challenges, implement innovative solutions, and navigate the dynamic landscape of technology-driven food systems. With this robust toolkit, students will be well-positioned to lead transformative initiatives, drive operational efficiencies, and foster sustainability across the food industry landscape.

Theoretical and experiential approaches to be adopted in the course:

In Course 19, a balanced blend of theoretical understanding and illustrative examples provides participants with a comprehensive exploration of the intersection between Blockchain and Artificial Intelligence (AI) within the food supply chain. Through a series of lessons and readings, participants will gain an understanding of fundamental concepts such as AI categorization, Blockchain technology and the structure of the food supply chain. They'll also delve into the intricacies of the food supply chain, from production to consumption, while identifying and analysing challenges across the various stages. The course highlights the potential of Blockchain and AI applications to improve efficiency, traceability, and sustainability within the food industry. Participants will learn about innovative technologies such as tokenization and decentralized marketplaces, as well as the integration of AI-driven smart contracts for enhanced traceability and decision-making. This theoretical framework is supplemented by illustrative examples, including video links, case studies, and real-world applications. Through these resources, participants enhance their ability to apply theoretical concepts to real-world scenarios. This balanced approach ensures that participants acquire both theoretical knowledge and practical skills necessary to navigate the complexities of this rapidly evolving field.

Tools and methods to be provided on the course:

This course employs a variety of engaging methods to equip participants with a comprehensive understanding of the integration between Artificial Intelligence (AI) and Blockchain Technology in revolutionizing the food supply chain. More specifically, the course offers:

- **Presentations:** Each lesson is accompanied by detailed presentations defining fundamental concepts, practical applications, and real-world case studies relevant to AI and blockchain technology in the food supply chain.

- **Curated Readings:** Participants will have access to a curated list of articles, books, and academic papers, providing supplementary resources for further exploration of specific topics covered in the course and facilitating deeper understanding.
- **Formative Assessments:** Formative assessments are incorporated into all lessons, featuring questions designed to assess participants' comprehension and retention of course materials. These assessments serve as checkpoints to ensure understanding and reinforce key concepts.
- **Quizzes:** Throughout the course, participants will encounter 5 quizzes strategically placed to assess comprehension, reinforce key concepts, and promote active learning.
- **External Video:** A specially selected external video serves as a refresher, strengthening fundamental concepts such as 'What is Artificial Intelligence?' and 'What is Blockchain?' It also explores the impact of blockchain on AI and the impact of AI on blockchain, providing a concise overview of these concepts and enhancing participants' understanding of the course material.
- **Additional Links:** Participants will be provided with additional links to relevant resources, websites, allowing for further exploration and expansion of knowledge beyond the limitations of the course curriculum.

These interactive elements, including formative assessments, quizzes, external video, and curated readings, are designed to enhance participant engagement, foster critical thinking, and deepen understanding, ensuring a dynamic and enriching learning experience in Course #19.

4.2.20 Course 20 - Roadmap for the use of Blockchain Technologies in the Food Supply

The overarching aim of the Course 20 (*developed by AFC*) is to empower participants with a deep understanding of blockchain's pivotal role and transformative potential within the complex landscape of the food industry. By delving into the intricacies of blockchain technology, participants will dissect the inherent inefficiencies and vulnerabilities present in conventional food supply chains, while concurrently uncovering the myriad benefits that blockchain offers, including heightened transparency, immutable traceability, and fortified trust among stakeholders. Through an immersive journey encompassing real-world case studies, critical analysis of blockchain components, and robust stakeholder engagement, participants will not only grasp the theoretical underpinnings but also gain practical insights into navigating regulatory landscapes, addressing interoperability challenges, and harnessing blockchain's prowess to elevate food safety standards, optimize quality assurance protocols, and catalyse sustainable practices across the entire food supply continuum. Ultimately, armed with this comprehensive knowledge and strategic acumen, participants will emerge poised to architect innovative solutions and chart pragmatic pathways for the seamless integration of blockchain technologies into the multifaceted realm of food supply chain management.

Course structure:

In the world of food supply, where security, transparency and efficiency play a key role, blockchain technology is becoming increasingly important. This course, "Roadmap for the use of Blockchain Technologies in the Food Supply " provides a fundamental understanding of how to implement blockchain technology to improve various aspects of the food supply chain. Through this course, participants will explore

the key concepts, challenges and potential of applying blockchain in the context of food supply, with an emphasis on transparency, traceability, security and reduction of food losses. In addition, the course will provide concrete examples and strategies on how to take advantage of blockchain technology to improve the quality and reliability of the food supply chain, giving consumers greater confidence in the food they consume. Table 22 presents the design of Course #20.

Table 21: Design of Course #20

Lesson	Lesson Title	Course Duration
1	Introduction to Blockchain Technology	Approximately 5 hours
2	Introduction to the food supply chain ecosystem	
3	Use cases and benefits of blockchain in the food industry	
4	Private vs. public blockchains	
5	Real-world examples of successful blockchain implementations	
6	Assessing the readiness and feasibility of blockchain adoption	
7	Protecting sensitive data on the blockchain	
8	Fair trade, sustainability, and responsible sourcing	

Lesson 1: Introduction to Blockchain Technology

- **Objective:** The main objective of the lesson "Introduction to Blockchain Technology " is to provide students with a comprehensive understanding of the underlying principles and mechanisms of blockchain technology, including its decentralized nature and cryptographic security. Through this understanding, students will be equipped to analyze and appreciate the potential applications and implications of blockchain across various industries and domains.
- **Content:** The lesson " Introduction to Blockchain Technology " covers the basic concepts of blockchain, including its decentralized structure and cryptographic principles. Additionally, it explores key components such as blocks, consensus mechanisms, and smart contracts, providing a foundational understanding for further exploration of blockchain technology.

Lesson 2: Introduction to the food supply chain ecosystem

- **Objective:** The main objective of the lesson "Introduction to the food supply chain ecosystem" is to familiarize learners with the various components, stakeholders, and challenges inherent in the food supply chain. By understanding these dynamics, students can explore potential solutions and innovations to address issues such as food safety, sustainability, and efficiency within the food system.
- **Content:** The lesson "Introduction to the food supply chain ecosystem" provides an overview of the complexities and dynamics within the food supply chain, including production, distribution, and consumption processes. It examines key stakeholders, challenges such as food safety and

sustainability, and emerging technologies aimed at improving transparency and efficiency within the ecosystem.

Lesson 3: Use cases and benefits of blockchain in the food industry

- **Objective:** The objective of the lesson "Use cases and benefits of blockchain in the food industry" is to demonstrate how blockchain technology can enhance transparency, traceability, and trust in food supply chains. Through analysing specific use cases and their associated benefits, learners will gain insights into the potential applications of blockchain to address key challenges within the food industry.
- **Content:** The lesson "Use cases and benefits of blockchain in the food industry" delves into real-world examples where blockchain technology has been successfully implemented to enhance food traceability, reduce food fraud, and improve supply chain efficiency. It explores how blockchain enables transparent record-keeping, facilitates quick identification of contamination sources, and fosters consumer trust by providing access to immutable data throughout the food supply chain.

Lesson 4: Private vs. public blockchains

- **Objective:** The objective of the lesson "Private vs. public blockchains" is to provide learners with a comprehensive understanding of the distinctions between private and public blockchains, including their governance structures, access controls, and applicability in various use cases. By the end of the lesson, students should be able to discern the advantages and disadvantages of each type and make informed decisions regarding blockchain implementations based on specific project requirements.
- **Content:** The lesson "Private vs. public blockchains" compares and contrasts the characteristics, governance models, and use cases of private and public blockchains. It explores the advantages and disadvantages of each type, including factors such as decentralization, scalability, and privacy, to help learners understand when to use one over the other in different contexts.

Lesson 5: Real-world examples of successful blockchain implementations

- **Objective:** The objective of the lesson "Real-world examples of successful blockchain implementations" is to illustrate how blockchain technology has been effectively utilized across diverse industries, showcasing its potential for enhancing transparency, security, and efficiency. Through examining concrete case studies, learners gain insights into practical applications of blockchain and understand its impact on business processes and societal challenges.
- **Content:** The lesson "Real-world examples of successful blockchain implementations" explores various case studies across industries such as finance, supply chain, healthcare, and government, highlighting how blockchain has been utilized to solve specific problems and drive innovation. By analysing these examples, learners gain a deeper understanding of the practical applications and benefits of blockchain technology in different sectors.

Lesson 6: Assessing the readiness and feasibility of blockchain adoption

- **Objective:** The objective of the lesson "Assessing the readiness and feasibility of blockchain adoption" is to equip learners with the necessary tools and methodologies to evaluate the suitability and potential impact of integrating blockchain technology into organizational processes. Through

understanding key factors such as regulatory compliance, technical infrastructure, and stakeholder readiness, participants can make informed decisions regarding the adoption of blockchain solutions.

- **Content:** The lesson "Assessing the readiness and feasibility of blockchain adoption" focuses on evaluating the organizational, technical, and regulatory factors that influence the suitability of blockchain implementation. It provides frameworks and methodologies for assessing the potential benefits, risks, and challenges associated with adopting blockchain technology in various contexts.

Lesson 7: Protecting sensitive data on the blockchain

- **Objective:** The objective of the lesson "Protecting sensitive data on the blockchain" is to educate learners on strategies and techniques to safeguard confidential information while leveraging the benefits of blockchain technology. It aims to explore cryptographic methods, privacy-enhancing technologies, and best practices for ensuring data security and privacy in blockchain-based systems.
- **Content:** The lesson "Protecting sensitive data on the blockchain" delves into cryptographic techniques such as encryption and hashing to secure sensitive information stored on the blockchain. It also examines privacy-focused blockchain solutions, including zero-knowledge proofs and selective disclosure mechanisms, to maintain confidentiality while leveraging the transparency and immutability of blockchain technology.

Lesson 8: Fair trade, sustainability, and responsible sourcing

- **Objective:** The objective of the lesson "Fair trade, sustainability, and responsible sourcing" is to raise awareness among learners about the importance of ethical practices in supply chains, emphasizing fair treatment of producers, environmental stewardship, and social responsibility. Through examining certifications, standards, and case studies, participants gain insights into promoting fair trade, sustainability, and responsible sourcing in their respective industries.
- **Content:** The lesson "Fair trade, sustainability, and responsible sourcing" explores the principles and practices of ethical supply chains, focusing on fair treatment of producers, environmental sustainability, and accountability throughout the supply chain. It discusses certifications, standards, and initiatives aimed at promoting fair trade and responsible sourcing practices in various industries.

Key objectives and learning outcomes:

The key objectives and learning outcomes of the course "Roadmap for the use of Blockchain Technologies in the Food Supply" are aimed at training participants with the necessary knowledge and skills for the successful implementation of blockchain technology in the food supply chain. Through the achievement of these goals, attendees will be equipped with the key knowledge and tools needed to effectively apply blockchain technology in the food supply, resulting in improved reliability, security and transparency of the entire supply chain.

Key Objectives:

- Understand the fundamental concepts of blockchain technology and its potential applications in the food supply chain.
- Explore real-world examples of successful blockchain implementations in food traceability, transparency, and supply chain management.
- Evaluate the benefits and challenges of adopting blockchain technology in the food industry.
- Analyse regulatory and legal considerations relevant to the implementation of blockchain in food supply chains.
- Develop strategies for integrating blockchain solutions to enhance traceability, reduce food fraud, and improve efficiency in the food supply chain.

Learning Outcomes:

- Demonstrate a comprehensive understanding of how blockchain technology works and its relevance to the food supply chain ecosystem.
- Identify key stakeholders, processes, and challenges within the food supply chain and assess how blockchain can address these challenges.
- Critically evaluate case studies and real-world examples to assess the effectiveness of blockchain solutions in improving food traceability and safety.
- Apply frameworks and methodologies to assess the feasibility and readiness of implementing blockchain technology in food supply chain operations.
- Develop a roadmap for the strategic adoption of blockchain in the food industry, considering factors such as scalability, interoperability, and data privacy.
- Communicate effectively about the benefits, risks, and considerations associated with blockchain adoption in the food supply chain to stakeholders and decision-makers.

Theoretical and experiential approaches to be adopted in the course:

The course "Roadmap for the use of Blockchain Technologies in the Food Supply" combines theoretical and experiential approaches to provide participants with a comprehensive understanding and practical skills in the implementation of blockchain technology in the food supply chain. Through this course, participants will explore both the theoretical underpinnings and practical applications of blockchain technology in food supply, enabling them to develop a deep understanding of the concepts and strategies required for successful real-world application.

The theoretical approach involves studying the basic principles of blockchain technology, including decentralization, distributed ledger, cryptographic security and smart contracts. Attendees will also explore the theoretical models and concepts behind the food supply chain, including monitoring, certification, audits and regulatory requirements.

The experiential approach includes practical activities such as case studies, simulations, workshops and creation of implementation plans. Participants will have the opportunity to apply their theoretical knowledge through practical examples from the real world and develop concrete strategies for implementing blockchain technology in the food supply chain, with the guidance and support of expert lecturers.

The combination of theoretical and experiential approaches enables participants to gain a deep understanding of the concept of blockchain technology and its application in food supply, and to develop the practical skills needed to successfully manage real-world implementation projects.

Theoretical Approaches:

- Lectures and Presentations: Deliver theoretical foundations of blockchain technology, its principles, and its potential applications in the food supply chain.
- Case Studies: Analyze real-world examples of successful blockchain implementations in food supply chains to understand practical challenges and benefits.
- Literature Review: Engage learners in exploring academic research and industry reports on the impact of blockchain on food traceability, transparency, and supply chain management.
- Frameworks and Models: Introduce conceptual frameworks and models for assessing the feasibility, readiness, and impact of blockchain adoption in the food industry.

Experiential Approaches:

- Simulations: Through simulated scenarios, participants will have the opportunity to experience the implementation of blockchain technology in food supply chains, giving them insight into the challenges and opportunities without real risk. This interactive method promotes understanding of concepts and encourages informed decision-making.
- Workshops and group discussions: Participants will have the opportunity to collaborate and exchange ideas through interactive sessions. Through group discussions, creative thinking and development of strategies for integrating blockchain technology into food supply chain operations is encouraged.
- Guest speakers: By inviting industry experts and practitioners who share their experiences in implementing blockchain solutions in the food sector, participants will gain practical insights, learn from their practices and become familiar with best practices.
- Field visits: The organization of visits to production facilities, warehouses and companies applying blockchain technology will provide participants with practical experience and insight into food supply chain operations and the application of blockchain technology in a real environment.
- Hands-on projects: Participants will have the opportunity to work in teams to design and prototype blockchain solutions for specific challenges within the food supply chain. This activity encourages creativity and innovation and enables the application of theoretical knowledge in a practical context.
- Internship: Providing opportunities for participants to participate in internships or internships in companies dealing with blockchain technology or food supply chain management allows them to gain practical experience in the industry and apply theoretical knowledge in a real business environment. This practice provides invaluable experience and increases the professional readiness of the participants for future challenges.

Tools and methods to be provided on the course:

The course will utilize detailed presentations to clearly outline the material of this course. Interactive resources, including relevant websites and online videos, will provide additional insights and contextual understanding. To facilitate a deeper understanding and application of the concepts discussed, case studies and scenario analyses will be integral to the course, enabling learners to apply their knowledge in practical settings. Specifically, the tools that will be provided are the following:

- **Course Presentation:** Each lesson is accompanied by comprehensive presentations focusing on blockchain applications in food quality assurance and certification. These presentations provide key concepts, processes, and real-world examples within the context of blockchain technology. They serve to ensure that all participants gain access to a uniform foundational understanding of roadmap for the Use of Blockchain Technologies in the Food Supply Chain
- **Recommended Readings:** A list of articles, books, and papers is provided for further exploration of specific topics. These readings are intended to deepen participants' understanding and extend their knowledge beyond the core course material.
- **Summative Assessments (Quizzes):** Short, regular quizzes have been designed to reinforce learning and ensure comprehension

5. Conclusions

The TRUSTFOOD Learning Ecosystem (under the scope of T3.2 and D3.2) represents a significant advancement in integrating blockchain technology into the agrifood sector, as well as a significant milestone in the TRUSTFOOD project. The TRUSTFOOD partners have successfully designed a series of 20 specialized courses aimed at transforming the food supply chain through digital innovation. Throughout “T3.2: TRUSTFOOD Learning Ecosystem”, the primary focus has been on designing an educational experience that blends deep theoretical insights with practical applications.

A number of significant entities contributed to the establishment of the TRUSTFOOD Learning Ecosystem and were essential to the delivery and enhancement of the courses provided. Content Providers were instrumental in designing the course structures and developing engaging, relevant content that aligned with the latest industry developments. Consultants gave crucial comments for improvement after reviewing the material to make sure it complied with learning objectives and standards. Infrastructure Consultants created a strong technical foundation to facilitate the transmission of content across several platforms, guaranteeing a smooth educational experience. Additionally, by translating all course materials into six different languages, translators were instrumental in opening up the courses to a larger audience.

The methodology behind this ecosystem and its underlying tasks was carefully crafted to ensure comprehensive and effective learning. It involved a collaborative approach, starting with a brainstorming session to identify potential courses, followed by a rigorous design and review process to finalize the course structures. This methodology emphasized an iterative development process, where feedback from various stakeholders was continually incorporated to enhance the course offerings. In terms of course design, the Learning Ecosystem focused on practical and interactive learning experiences, combining theoretical knowledge with real-world applications. A total of 20 courses were created (which were later be translated into six languages), covering topics from the principles of blockchain technology to its specialized applications in food supply chain management, including traceability, smart contracts, and ethical considerations. Each course was designed to evolve from fundamental principles to more sophisticated ones, ensuring a complete understanding of blockchain technology and its potential impact on the food supply chain.

Concluding, D3.2 has been primarily focused on the design of the educational courses, setting the foundational framework for the TRUSTFOOD Learning Ecosystem. This work will be extended in T3.4, where the development of the courses will incorporate interactive approaches and translations, resulting in a set of 140 distinct courses in total. These advancements will be demonstrated and documented in D3.4, ensuring a detailed record of the project’s progression and the educational resources developed.

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7. Appendices

7.1 Template for Course Quiz



<COURSE NAME>

<Lesson #: Lesson Name>

SUMMATIVE ASSESSMENT - QUIZ

Question 1 (multiple choice)

Question: Multiple choice question goes here.

- a. Option 1
- b. Option 2
- c.

Correct Answer: (a) & (b)

Question 2 (single choice)

Question: Single choice question goes here.

- d. Option 1
- e. Option 2
- f.

Correct Answer: (a)


Question 3 (true/false)

Question: True or False question goes here.

Correct Answer: True




7.2 Template for Course Presentation

The TRUST FOOD logo is located in the top right corner of the slide template. It consists of the words "TRUST" and "FOOD" in blue and green, with a stylized network graphic to the right.

TRUSTFOOD
<Course Title>

<Lesson x: Lesson/Module Title>

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Introduction & Objectives



INTRODUCTION & LESSON DESCRIPTION:

- XXXXX

OBJECTIVES:

- XXXXX

Key Concepts

- XXXXXXXX

Learning Outcomes

- XXXXXXXX

A decorative diagonal bar in the top-left corner of the slide, with a purple upper triangle and a green lower triangle.

<CONTENT>

- <CONTENT>

Formative Assessment

- Question 1:
- Question 2:
-
-

- *Note 1: Formative assessment refers to a range of formal and informal assessment procedures conducted by teachers during the learning process in order to modify teaching and learning activities. Formative assessment aims to monitor student learning and provide ongoing feedback without evaluation.*
- *Note 2: Provide the answers to the Questions in the Notes*
- *Note 3: These questions are not mandatory to be included at the end of the lesson. They can be incorporated whenever needed throughout the lesson.*

Summary & Key Takeaways



SUMMARY

- XXXXX

KEY TAKEAWAYS:

- XXXXX

References



1. Use [Harvard](#) reference style
2. Xxxxx
3. Xxxxx
4. xxxx

Further Readings

1. Use [Harvard](#) reference style
2. Xxxxx
3. Xxxxx
4. xxxx



THANK YOU

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