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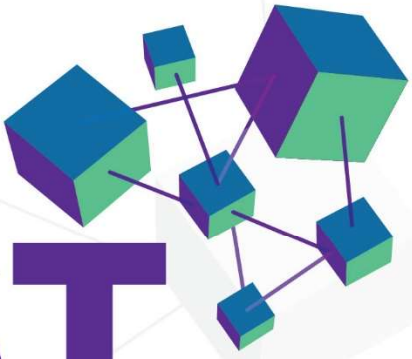

TRUST FOOD

Trainer Handbook

English

TRUSTFOOD

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English

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Introduction

In recent years, blockchain has emerged as a revolutionary technology, promising transparency, security, and efficiency across various industries. One of the most promising applications of blockchain lies in transforming the global food supply chain. The food supply chain is inherently complex, spanning multiple stages from production to consumption. Traditional supply chain systems often suffer from inefficiencies, lack of transparency, and susceptibility to fraud or contamination. With consumers increasingly demanding transparency and accountability in the sourcing and distribution of food products, blockchain presents a sufficient solution to address these concerns because it offers a decentralized, immutable ledger system that can revolutionize the way we track, trace, and verify the journey of food products from farm to fork.

TRUSTFOOD is a Digital Europe initiative that offers short-term training programs aimed at upskilling and reskilling the workforce, particularly targeting owners, managers, and employees of SMEs in the food supply chain sector. The project aims to enhance the advanced digital skills of the workforce, especially within SMEs, and extends to job seekers by offering access to specialized training courses. These courses incorporate the latest advancements in blockchain technologies as applied comprehensively to the food supply chain. The courses are highly practical, providing in-depth knowledge of blockchain and its specific applications in the food supply chain. More specifically, the TRUSTFOOD platform offers twenty (20) courses with a total number of one hundred twenty-seven (127) lessons that comprise ninety-two hours (92) and forty-five (45) minutes of training.

This handbook offers to trainers a brief presentation of appropriate learning theories as well as ice breaking techniques and useful methods the increase the engagement of trainees. Moreover, it provides information regarding the content and duration of each course, it's objective and learning outcomes, the course level, education level required, and prerequisites, the target audience, information regarding the assessment, the certification of attendance and badges, guidelines for each one of the lessons offered, as well as relevant readings. With the guidelines section, trainers have an additional tool in their hands on how to deliver the content to trainees to achieve the maximum understanding and results.

Learning Theories

Delivering courses regarding the blockchain in the food supply chain requires careful planning to ensure that participants will understand the objective of the courses. The choice of learning theory can significantly impact how participants engage with and retain information. Selecting the appropriate learning theory for delivering a course involves considering several factors related to the course's content, objectives, and the needs and preferences of your target audience. Before starting, please consider the following:

Understand the audience: Begin by understanding the characteristics and preferences of your learners. Consider factors such as their occupation, if they are involved in supply chain, age, prior knowledge regarding blockchain technology and/or food supply chain, learning styles, and cultural background. Are they beginners or experts in blockchain for food supply chains?

Understand the learning objectives: Review the learning objectives of the course that you will teach. What do you want trainees to know, understand, or be able to do by the end of the course? Learning objectives will guide your choice of learning theory.

Consider course content: Review the content of the course available on the TrustFood learning environment. Is it highly technical, conceptual, practical, or theoretical? Different learning theories are more suited to specific types of content. For example, social cognitive theory may be suitable for practical skills, while constructivism may be better for conceptual understanding.

Select a learning theory: Based on the above considerations, choose a learning theory or a combination of theories that align with your audience, learning objectives, content, and goals. The following learning theories could be considered (learning theories have been presented in more detail in deliverable D2.1 of TrustFood):

- *Constructivism*: Encourages learners to construct knowledge through active engagement, often used for more exploratory and open-ended learning. The TrustFood learning environment integrates constructivist principles by offering interactive and problem-solving activities centred around blockchain and supply chain management.
- *Behaviourism*: Focuses on observable behaviours and reinforcement, suitable for skill-based or procedural learning. Behaviourist approaches can be employed in digital learning by incorporating rewards and feedback mechanisms to reinforce learners' understanding of blockchain concepts and their application in supply chain management.
- *Social Cognitive Theory*: Emphasizes mental processes like memory, problem-solving, and critical thinking, suitable for knowledge acquisition and problem-solving. TrustFood's digital learning environment can facilitate observational learning and social interaction using video lectures, webinars, and expert interviews. Learners can observe experts discussing and demonstrating blockchain applications in supply chains, and can participate in interactive online activities, such as peer assessments, group projects, or discussion forums, to enhance their understanding through social interaction.
- *Humanism*: Emphasizes the growth of the individual and gives importance on the cognitive, emotional, and social aspects of learning. The value of personal freedom, self-actualization, and development is emphasized by humanism. A humanistic approach to digital learning can be achieved by creating a supportive online community where learners feel valued and respected.
- *Connectivism*: Relies on networked and digital learning environments, suitable for information-rich and technology-enabled courses. Digital learning environments can embrace connectivism principles by encouraging learners to develop their personal learning networks and access diverse sources of information related to blockchain and supply chain management.

The choice of learning theory should be flexible and adaptable based on the specific needs of your learners and the learning objectives of the courses. The goal is to create a learning experience that is engaging, effective, and aligned with the course objectives. In many cases, a blended learning approach that combines elements of different learning theories may be the most effective. For example, use behaviourist approaches for introductory knowledge and constructivist methods for application and problem-solving.

Ice Breakers & Methods for Engagement

Icebreakers and methods for engagement of trainees include a variety of activities, games, and inquiries tailored to create a welcoming and engaging atmosphere for both trainers and trainees. Their primary purpose is to facilitate communication among participants, and an environment where they feel comfortable

speaking with one another, exchange opinions and experience aiming at effective learning. It is essential to adapt icebreaker and methods for engagement of trainees according to the group and context. For example, teaching adults requires a different approach compared to children and teenagers. The following could be considered:

Make Clear the Learning Objectives: Clearly communicate the learning objectives and what participants will gain from the TrustFood training course. Knowing the purpose and expected outcomes can motivate trainees to pay attention.

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to blockchain and supply chain. This not only provides insights into their backgrounds but also identifies potential resources within the group and helps break the initial awkwardness and sets a friendly tone.

Humour and Fun Facts: Infuse humour into the session by sharing jokes or interesting facts related to the blockchain and supply chain. This can help create a positive atmosphere and reduce tension.

Visual Icebreakers: Use visual aids or props to stimulate discussion. This could involve showing relevant images, using objects related to blockchain and supply chain, or incorporating visual metaphors to engage participants.

Instant Story: Ask each learner to say the first food product they have in their mind and start discussing about origin and traceability of that product. You could also ask them to think about positive and negative experiences regarding food products.

Active Participation: Encourage active participation rather than passive listening. Use interactive activities, discussions, group work, or hands-on exercises to involve trainees and keep them engaged.

Real-World Relevance: Emphasize the practical relevance of the training material. Show how the concepts or skills being taught can be applied in Food Supply Chain (FSC) and the benefits of doing so.

Storytelling: Share relevant stories or case studies that illustrate key points for FSC, blockchain, traceability and more. Stories can make the content memorable.

Questioning and Discussions: Ask questions and encourage trainees to ask questions and engage in discussions.

Peer Learning: Encourage peer interaction and collaborative learning. Trainees can learn from each other's experiences and perspectives.

Personalization: Trainees may have different levels of prior knowledge and diverse learning preferences. Therefore, the training experience shall be adapted as much as possible to individual needs and interests.

Breaks: Plan for regular short breaks during longer training sessions to allow participants to recharge. Short breaks help prevent mental fatigue.

Feedback and Encouragement: Provide constructive feedback and positive reinforcement to keep trainees motivated.

Interactive videos: Trainees can improve their basic and/or advanced skills with the use of interactive videos. For example, they could be real-world use cases or challenges to demonstrate how blockchain can enhance

transparency, traceability, and overall efficiency in the food supply chain. Trainees can then engage in problem-solving activities within the video.

Gamification: Introduce gamification elements such as quizzes, challenges, or rewards to make learning fun and competitive. Gamification can motivate trainees to participate actively and compete with their peers.

Course #1: Introduction to Blockchain Technology and Digital Assets

Content and Duration

The lessons provided with the course "Blockchain Applications for Food Quality Assurance and Certification" are as follows:

Lesson 1: Short history of money and how bitcoin was created

Lesson 2: Fundamentals of blockchain technology

Lesson 3: Blockchain technology and transactions

Lesson 4: Blockchain Management System. Composition and types

Lesson 5 : Bitcoin and Ethereum Basics

Lesson 6: DeFi

Lesson 7 : Blockchain in Food Supply Chain: An Outlook

Approx. 4 hours to complete (including study time).

Objective

This course empowers learners with a thorough grasp of blockchain technology, its underlying architecture, and its disruptive potential across industries. We'll explore core blockchain concepts, delve into the secure structure of these systems, and analyze the differences between public, private, and consortium models. The course also introduces learners to the world of digital assets like cryptocurrencies and NFTs. Finally, we'll utilize the food supply chain as a real-world example to showcase how blockchain can revolutionize transparency and security in various industries.

Learning Outcomes

What your trainees will learn:

- Understand the fundamental concepts of blockchain technology.
- Understand the architecture and components of a blockchain system.
- Understand the differences between public, private, and consortium blockchains.
- Understand the use cases for digital assets like cryptocurrencies and NFTs.
- Understand the potential benefits of blockchain implementation in the food supply chain.

Course Level - Education Level Required – Prerequisites

Beginners, Professional Development or Continuing Education

High School Diploma or Equivalent

Economics basics

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees and food supply chain personnel

Assessment - Certification of Attendance – Badges

The assessment for this course is realized with the corresponding quizzes

A certificate of attendance will be provided upon completion of all lessons and quizzes

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Lesson 1: Short history of money and how bitcoin was created

This lesson dives into the exciting world of Bitcoin and digital currencies.

Balanced Approach: Dedicate roughly half the lesson to the history of money and the other half to Bitcoin's creation and technology. This ensures both elements are covered in the lesson title.

Flow and Connection: When discussing the history of money, highlight the need that led to each innovation. For example, explain how barter became inconvenient, paving the way for standardized currencies. Then, connect this to Bitcoin's emergence as a response to limitations in traditional currencies.

Intriguing History: Use interesting examples from the history of money. For instance, you could mention using cowrie shells or Rai stones as currency. This will capture learners' attention and illustrate the evolution of money.

Focus on Blockchain: When explaining Bitcoin, delve deeper into blockchain technology. Explain how it works using simple analogies or diagrams, not getting bogged down in technical details.

Real-World Examples: Use real-world examples to illustrate concepts. For instance, discuss how online retailers are increasingly accepting Bitcoin payments.

Satoshi Nakamoto: Briefly mention Satoshi Nakamoto as the pseudonym of Bitcoin's creator without going into too much detail. The focus should be on the technology and its historical context.

Lesson 2: Fundamentals of blockchain technology

This lesson delves into the core concepts of blockchain technology.

Focus on Clarity: While the lesson covers the history of cryptography, prioritize explaining its role in blockchain. Keep historical details concise and relevant.

Interactive Examples: Illustrate cryptographic concepts with real-world examples. For example, explain how encryption works using sending a secret message with a padlock and key.

Demystify Cryptography: Break down encryption and decryption processes into simple steps. Explain the differences between symmetric and asymmetric key cryptography using relatable analogies.

Hashing in Action: Demonstrate how a hash function works using a step-by-step example. Emphasize the key properties of cryptographic hashes like immutability and collision resistance.

Blockchain Security: Clearly explain how cryptography and hashing functions work together to ensure the security and immutability of the blockchain.

Applications and Challenges: Briefly touch upon potential applications of blockchain technology beyond Bitcoin. Mention some existing challenges like scalability and energy consumption.

Further Exploration: Encourage learners to explore specific areas of interest like different consensus mechanisms or specific blockchain applications.

Lesson 3: Blockchain technology and transactions

This lesson dives into the specifics of blockchain technology and transactions.

Simplify Decentralisation: Explain the concept of a distributed ledger in clear terms. Avoid overly technical language or deep dives into alternative ledger technologies (DLT).

Focus on User Flow: Walk learners through a typical blockchain transaction step-by-step. Explain the roles of senders, receivers, miners (if applicable), and how digital signatures ensure security.

Transaction Components: Clearly define and explain the purpose of transaction inputs, outputs, and metadata. Use relatable examples to illustrate each component.

Public vs. Private Keys and Addresses: Explain the difference between public and private keys using an analogy. For example, compare them to a mailbox and a key. Public addresses can be presented as an account number on a blockchain network.

Digital Signatures: Explain the concept of digital signatures without going into complex cryptography. Focus on how they validate transactions and prevent tampering.

Briefly mention the concept of a seed phrase or mnemonic sentence as a backup for private keys.

Consider using diagrams to visualise the process of a blockchain transaction.

Lesson 4: Blockchain Management System. Composition and types.

This lesson delves into the world of Blockchain Management Systems (BMS) and different blockchain network types.

Focus on Core Concepts: Clearly define DLT (Distributed Ledger Technology) and its core properties like immutability and transparency. Explain how BMS leverages DLT for managing blockchains.

Visual Aids: Use diagram (slide # 9) to illustrate the different types of blockchain systems (public, private, consortium, hybrid). Highlight the key differences in terms of access control, governance, and use cases.

Public Blockchains: Explain the concept of open participation and consensus mechanisms (like Proof of Work) used in public blockchains. Use Bitcoin or Ethereum as examples.

Private Blockchains: Discuss permissioned access and the role of a central authority in private blockchains. Highlight the benefits of privacy and scalability. Provide use cases in supply chain management or finance.

Consortium Blockchains: Explain how a consortium operates and how governance is shared among trusted members. Mention potential applications in trade finance or regulatory compliance.

Hybrid Blockchains: Introduce the concept of customization and how hybrid blockchains combine features from public and private networks. Showcase use cases where a blend of transparency and control is desired.

Comparison Chart: Summarize the key characteristics of each blockchain type in a table or chart for easy reference.

Choosing the Right Blockchain: Discuss factors to consider when selecting a blockchain type for a specific application.

Future of Blockchain Management: Briefly touch upon emerging trends in BMS, such as interoperability between different blockchain networks.

Lesson 5: Bitcoin and Ethereum Basics.

This lesson delves into the Bitcoin and Ethereum Basics.

Deep Dive into Bitcoin: Dedicate a section to Bitcoin, explaining its origin, core functionalities (peer-to-peer transactions, digital currency), and underlying technology (blockchain). Discuss the UTXO model and its advantages (security, privacy).

Introduce Ethereum: Transition to Ethereum, highlighting its role as a platform for decentralized applications (DApps) and smart contracts.

Focus on Smart Contracts: Dedicate ample time to explaining smart contracts - their concept, how they work, and their potential to transform various sectors (finance, supply chain).

Ethereum vs Bitcoin: Conclude with a clear comparison table contrasting Bitcoin and Ethereum based on key features (purpose, consensus mechanism, transaction speed).

Scalability Challenges: Briefly discuss the scalability limitations of both Bitcoin and Ethereum. Mention potential solutions being explored, like Proof-of-Stake for Ethereum.

Security Considerations: Briefly address the importance of secure practices when dealing with cryptocurrency wallets and smart contracts.

The Future of Blockchain: Conclude by sparking curiosity about the future potential of blockchain technology and its impact on various sectors.

Class Discussion: Facilitate a class discussion on the potential applications of Bitcoin and Ethereum across different industries.

Lesson 6: DeFI.

This lesson delves into the DeFi.

Define DeFi: Clearly define DeFi (decentralized finance) and emphasize its key features: eliminating intermediaries, leveraging smart contracts, and fostering open and accessible financial services.

Decentralization, Transparency, Accessibility: Explain these core principles in detail and how they benefit DeFi users. Use visuals (diagrams, flowcharts) to enhance understanding.

Highlight Advantages: Discuss the numerous benefits of DeFi, including lower fees, innovative products, and financial inclusion for the unbanked.

Acknowledge Risks: Mention the inherent risks associated with DeFi, such as security vulnerabilities, smart contract exploits, and market volatility.

Decentralized Exchanges (DEXes): Explain DEXes, their benefits (peer-to-peer trading, reduced fees), and how they function using smart contracts.

Lending Platforms: Discuss DeFi lending platforms, how they enable crypto borrowing and lending, and the concept of yield farming for generating passive income.

Stablecoins: Introduce stablecoins, their role in DeFi (adding stability and facilitating transactions), and different types of stablecoins (fiat-backed, crypto-backed).

Lesson 7: Blockchain in the food supply chain.

This lesson delves into the Blockchain in the food supply chain.

Challenges of Traditional Supply Chains: Discuss the limitations of traditional food supply chains (lack of transparency, food safety concerns, inefficiencies).

Blockchain's Potential: Explain how blockchain can address these challenges by providing an immutable record of food journeys, enhancing traceability, and improving food safety.

Unveiling Food Origins: Discuss how blockchain empowers consumers to trace food origins, fostering trust and informed purchasing decisions.

Ensuring Food Safety: Explain how blockchain facilitates faster identification and isolation of contaminated products, safeguarding public health.

Streamlined Operations: Highlight how blockchain streamlines processes, eliminates intermediaries, and reduces costs.

Acknowledge Hurdles: Discuss challenges of blockchain adoption (cost, scalability, regulations).

The Future of Food: Explore the future potential of blockchain in the food supply chain (enhanced traceability, streamlined operations, sustainable practices).

Relevant Readings

"Bitcoin: A Peer-to-Peer Electronic Cash System" by Satoshi Nakamoto https://bitcoin.org/bitcoin.pdf

"Mastering Bitcoin: Unlocking Digital Cryptocurrencies" by Andreas M. Antonopoulos

"The Basics of Bitcoins and Blockchains" by Antony Lewis

"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher

"Blockchain Revolution: How the Technology Behind Bitcoin Is Changing Money, Business, and the World" by Don Tapscott and Alex Tapscott

"Blockchain: The Complete Guide to Understanding Blockchain Technology, Bitcoin, Cryptocurrency and the Future of Money" by Mark Gates

"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" by Arvind Narayanan

"Blockchain Technology Explained: The Ultimate Beginner's Guide About Blockchain Wallet, Mining, Bitcoin, Ethereum, Litecoin, Zcash, Monero, Ripple, Dash, IOTA and Smart Contracts" by Alan T. Norman

"Blockchain: A Practical Guide to Developing Business, Law, and Technology Solutions" by R. Todd Stephens, et al.

"Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction" by Arvind Narayanan.

"Blockchain: A Technical and Business Perspective" by R. Todd Stephens

"ANALYSIS AND SOLUTION OF THE CONCEPTUAL AND TERMINOLOGICAL PROBLEM OF THE BLOCKCHAIN CONCEPT DEFINITION" by Sergiy Obushnyi, Roman Kravchenko, Leonid Khatskevych, Sergii Nekrasov, Artem Frantsiian https://journal.eae.com.ua/index.php/journal/article/view/92/83?fbclid=IwAR1GvC3W-8_Ymvm1d97w_L0E8Lb3y5NaLlWwXI_IpK946i54bo5zbmOCycE

Course Provider - Contact Details

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Course #2: Exploring Digital Asset Management and Tokenization

Content and Duration

The lessons provided with the course “Exploring Digital Asset Management and Tokenization” are as follows:

Lesson 1: Contextualizing Blockchain in the Agrifood Supply Chain

Lesson 2: Introduction to digital assets in the food supply chain

Lesson 3: Types of digital assets

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

Lesson 5: The Fundamentals of Digital Asset Management

Lesson 6: Potential benefits and challenges of digital asset management and tokenization in the agrifood industry

Lesson 7: Exploring Real-world Implementations

Lesson 8: Future trends and advancements in digital asset management and tokenization

Approx. 5 hours to complete (including study time).

Objective

The objective of this course is to understand the fundamentals of digital assets and tokenization within the context of the food supply chain. The course begins with a foundational objective, which is to ensure that participants gain a solid understanding of the fundamentals of digital assets and tokenization. This knowledge is contextualized within the food supply chain, highlighting the relevance and application of these concepts in this specific area. A significant part of the course is dedicated to exploring how blockchain technology can be utilized to manage digital assets efficiently and facilitate the process of tokenization in the food industry. This exploration will not only cover theoretical aspects but also delve into practical applications, demonstrating how blockchain can transform the way digital assets are handled in the food sector. Finally, the course aims to bridge the gap between theory and practice. It focuses on the application of the acquired knowledge about digital assets and tokenization to real-world scenarios in the food supply chain. This objective is crucial as it allows learners to translate their understanding into practical skills that can be applied in real-life situations, enhancing the relevance and impact of their learning experience.

Learning Outcomes

As a trainer guiding learners through a course on blockchain technology, smart contracts, and digital assets in the agrifood sector, the following learning outcomes have been structured to ensure a comprehensive and effective training program:

- Fundamentals of Blockchain Technology: Trainees need to gain a solid foundational understanding of blockchain technology, including its key characteristics and origins.
- Classification of Blockchains: Trainees need to learn to categorize blockchains into their respective types.
- Understanding of Smart Contracts: As a trainer you need to guide trainees to explore the mechanics of smart contracts, comprehending how they are operated, triggered, and executed.
- Blockchain's Impact on Agrifood Supply Chains: Trainees need to recognize the transformative potential of blockchain and smart contracts in agrifood supply chains.
- Defining Digital Assets: Trainees need to be able to define digital assets and understand their evolution in the agrifood context.
- Digital Assets in Food Supply Chain: Trainees need to recognize the significance of digital assets in food supply chain management, focusing on aspects like traceability, quality assurance, and operational efficiency.
- Knowledge of NFTs and Tokens: Trainees need to gain knowledge about NFTs, Utility Tokens, and Security Tokens, understanding their unique characteristics and benefits.
- Choosing the Right Digital Asset: Trainees need to learn the importance of selecting appropriate digital assets for specific applications in the agrifood sector.
- Transparency and Traceability in Agrifood Sector: Trainees need to gain insights into how digital assets can ensure unprecedented levels of transparency and traceability.
- Digital Asset Management (DAM) Essentials: Trainees need to clearly define DAM and articulate its strategic importance in the agrifood sector. Additionally, trainees need to recognize how blockchain technology can be integrated into DAM systems effectively and assess DAM's value proposition.
- Case Study Analysis and Future Trends: Trainees need to understand various case studies and the solutions they offer. Participants will be equipped to anticipate and adapt to technological, regulatory, and market changes affecting DAM and tokenization.

Course Level - Education Level Required - Prerequisites

Intermediate Level

Minimum education level required: High School Diploma or Equivalent

This is an advanced course of TrustFood Course #1: Introduction to Blockchain Technology and Digital Assets

Target Audience

Generic, Agrifood Industry Professionals, Technology Professionals and Developers, Business Strategists and Entrepreneurs, Supply Chain and Logistics Managers, Educators and Academics, Students in Related Fields, Technology Consultants and Advisors.

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through the dynamic field of digital assets and tokenization in the food supply chain, this course handbook is designed to support you in delivering an engaging and informative course. Here are the key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Interactive Introductions and Expertise Mapping: Initiate sessions with introductions, encouraging participants to share their background and experiences related to blockchain and supply chain. This activity fosters a collaborative learning environment and helps identify shared experiences and expertise within the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Demystifying Blockchain Technology: A central part of your training will involve elucidating how blockchain technology can be leveraged for efficient management of digital assets and tokenization within the food industry. This section should include both theoretical perspectives and practical applications, demonstrating blockchain's transformative potential in the digital management of the food supply chain.

Practical Application: The most impactful aspect of your training will be guiding participants in applying their knowledge to real-world scenarios within the food supply chain. Encourage hands-on activities, discussions, and case studies to help learners translate theoretical concepts into practical solutions and strategies.

Given that this course is an advanced level following “Course 1: Introduction to Blockchain Technology and Digital Assets” it's important to:

- Review and build upon the foundational knowledge from Course #1.
- Utilize the provided course materials, such as detailed slides and interactive resources, to facilitate an immersive learning experience.

Incorporating Humour and Fun Facts: Use humour and interesting anecdotes related to blockchain and supply chains to create a relaxed and engaging atmosphere.

Visual Icebreakers: There are several visual “helpers” within the course that could help you stimulate the interest and discussions regarding digital asset management and tokenization. For example:

- You could use the image in Lesson 1, slide 5 to provide an overview of the agrifood supply chain.
- You could use the image in Lesson 1, slide 9 and the video in Lesson 1, slide 10 to visually present how blockchain works step-by-step.
- You could use the video presented in Lesson 2, slide 9, to stimulate the interest about the evolution of digital assets.
- You could use the video in Lesson 3, slide 10 to showcase a use case of NFTs in the agri-food.
- You could use the image in Lesson 4, slide 6 to to provide an overview and visually present the involved entities in the food supply chain.
- You could use the video presented in Lesson 5, slide 6 to describe what is the digital asset management.

- You could use the video available in Lesson 7, slide 16 to demonstrate a real world use case that transforms the global agrifood system.
- You could simulate the interest by encouraging participants to watch relevant TEDx talks like the own available in Lesson 8, slide 11.

Instant Story Technique: Encourage participants to share their thoughts on a specific food product, discussing its origin and traceability. This can lead to conversations about real-world applications of blockchain.

Fostering Discussion and Inquiry: Encourage questions and discussions among trainees. This not only clarifies concepts but also promotes critical thinking.

Lesson 1: Contextualizing Blockchain in the Agrifood Supply Chain

Start with an engaging narrative or real-world example that demonstrates the intersection of technology and the agrifood supply chain. This sets the stage for the lesson and piques interest. Use visual aids or infographics to illustrate how blockchain technology is revolutionizing the agrifood sector. Clearly present the objectives at the beginning. Use simple language to ensure that all trainees, regardless of their prior knowledge, understand the goals of the lesson.

Break down complex concepts into digestible segments. Use examples and analogies to explain technical terms like nodes, blocks, chains, and consensus mechanisms.

After introducing key concepts, summarize the learning outcomes. This reinforces what trainees should focus on and what they will achieve by the end of the lesson.

Highlight the role of technology in improving efficiency, traceability, quality assurance, sustainability, and consumer engagement in the agrifood supply chain.

Explain blockchain and smart contracts in simple terms. Discuss their mechanics and how they contribute to transparency and efficiency in the agrifood sector.

Conclude the lesson with a summary of the key points. Encourage trainees to reflect on what they have learned and how they can apply this knowledge.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds (IT, supply chain etc) and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 2: Introduction to digital assets in the food supply chain

Start with a brief overview of the evolution and importance of digital assets in the agrifood sector. Use real-world examples to illustrate their impact. Use infographics or timelines to depict the history and growth of digital assets.

Clearly define digital assets, emphasizing their characteristics and types. Clarify the distinction between digital assets on and off blockchain.

Discuss the role of digital assets in enhancing the food supply chain, focusing on traceability, quality assurance, and efficiency. Use case studies or scenarios to demonstrate how digital assets are applied in supply chain management.

Explain cryptocurrencies and their evolution and introduce the concept of tokenization in the supply chain.

Elaborate on the fundamental nature, value components, and legal framework of digital assets.

Describe the process of asset tokenization, discussing its benefits from both the asset owner's and investor's perspectives.

Include examples of assets that can be tokenized and their benefits.

Highlight the role of digital assets in ensuring food safety and quality, using specific examples.

Conclude with a summary of key concepts covered in the lesson, reinforcing the importance of digital assets in the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Engage trainees with questions to assess their understanding of Ethereum's significance in the evolution of digital assets.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 3: Types of digital assets

Begin with a brief recap of digital assets from Lesson 2, setting the stage for a deeper dive into their types. Use a summary slide from Lesson 2 to refresh key concepts.

NFTs: Explain Non-Fungible Tokens (NFTs) focusing on their uniqueness, indivisibility, and how they enable digital ownership and traceability. Use examples relevant to agrifood, like digital art or collectibles.

Utility Tokens: Define Utility Tokens, emphasizing their role in decentralized applications and their use as a medium of exchange within a specific ecosystem.

Security Tokens: Describe Security Tokens, highlighting their function as digital representations of ownership or a stake in an asset, and their regulatory compliance requirements.

Detail specific use cases of each token type in the agrifood supply chain, such as tracking land ownership or livestock with NFTs, using utility tokens for loyalty programs, or security tokens for fractional ownership of agricultural assets.

Clearly differentiate between NFTs, Utility Tokens, and Security Tokens, focusing on ownership, divisibility, regulatory Discuss the regulatory landscape for each type of digital asset, emphasizing the importance of compliance.

Analyse the advantages and disadvantages of each digital asset type, helping trainees understand their practical implications.

List pros and cons for each type, possibly followed by a group discussion or brainstorming session.

Emphasize the importance of selecting the appropriate digital asset type based on project goals, regulatory compliance, and market considerations.

Conclude with a summary of the lesson, reinforcing the diverse landscape of digital assets and their strategic importance in different contexts.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Encourage discussion by presenting case studies or hypothetical scenarios, prompting trainees to identify which type of digital asset would be most appropriate in various agrifood scenarios.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

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

Begin by establishing the context of how digital assets interact with the agrifood supply chain, explaining their transformative potential.

Discuss how digital assets optimize procedures within the agrifood supply chain.

Highlight how digital assets enhance openness and accountability in transactions and product journeys.

Explain how the use of digital assets leads to reduced expenses or capital requirements in the agrifood supply chain.

Discuss the specific benefits digital assets offer, such as faster transactions, verifiable product quality, and incentives for sustainable practices.

Explore the impact of digital assets on these groups, discussing new revenue models, operational efficiencies, transaction security, etc.

Present how digital assets bring innovation, consumer insights, verifiable quality, cost reduction, market access, and real-world utility.

Wrap up the session by summarizing how digital assets reshape the agrifood supply chain operations and impact stakeholders.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Encourage trainees to think about how digital assets transform traditional operations in the food supply chain.

Lesson 5: The Fundamentals of Digital Asset Management

Begin with an overview of Digital Asset Management (DAM) and its significance in the agrifood sector.

Clearly explain what DAM is, emphasizing its role as a centralized repository for managing digital resources.

Utilize definitions and key points, possibly supplemented with a short video or graphic illustrating DAM's function. Discuss how DAM contributes to resource efficiency, supply chain insights, and regulatory adherence in the agri-food sector.

Highlight the key benefits of DAM, such as cost and resource management, organizational clarity, boosted productivity, customer engagement, and robust security.

Explain the critical features of DAM systems, such as asset creation, encoding and indexing, version control, integrated compliance, and user permission control. Stress the importance of DAM integration with existing systems like CRMs, ERPs, and SCMs.Discuss various storage options for digital assets, including cloud benefits, on-premise advantages, and the role of blockchain.

Investigate how blockchain enhances DAM, focusing on security, audit trails, smart contracts, and decentralization.

Address potential challenges such as GDPR concerns, blockchain types, volume constraints, energy impact, and initial investment.

Conclude with a summary of the key points, emphasizing the synergy between DAM and blockchain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 6: Potential benefits and challenges of digital asset management and tokenization in the agrifood industry

Open with a brief introduction that outlines the focus of the lesson: exploring the benefits and challenges of DAM and tokenization in the agrifood industry.

Review key concepts such as Digital Asset Management, Tokenization, Regulatory Compliance, and Technological Complexity.

Discuss the various benefits of DAM and Tokenization, such as streamlining of digital assets, reduced redundancy, brand consistency, automation, and streamlined workflows.

Elaborate on the specific benefits of tokenization, including enhanced security, increased liquidity, lower costs, transparency, and improved supply chain management.

Discuss challenges such as storage and scalability, privacy concerns, high implementation costs, and global regulation.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 7: Exploring Real-world Implementations

Begin by outlining the practical applications of tokenization and digital assets in the agrifood industry, focusing on supply chain operations.

Discuss real-world implementations, focusing on supply chain traceability, farm-to-fork transparency, retail innovations, and consumer engagement.

Present a series of case studies, such as “Trace My Egg” and “TE-FOOD”, discussing their objectives, implementations, benefits, and unique features.

Discuss factors that enable blockchain adoption in smart and sustainable agriculture, like stakeholder collaboration, trust enhancement, and data security.

Address challenges such as privacy concerns, standardization issues, resource constraints, and technical complexities.

Encourage discussion on how real-world implementations demonstrate blockchain's potential and identify key enablers and barriers.

Summarize the session by revisiting the explored case studies and their significance in the agrifood sector.

Incorporate interactive elements like polls or questions to assess trainees’ initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 8: Future trends and advancements in digital asset management and tokenization

Introduce the lesson by highlighting its focus on future trends in DAM and tokenization, particularly in the agri-food sector.

Discuss the continuous transformation of digital assets as technology advances.

Explain the importance of compatibility between various blockchain platforms and DAM systems. Cover how regulations are shaping the future of digital assets.

Introduce new applications emerging for digital assets and tokenization.

Discuss the expansive growth of tokenized assets and their impact across various sectors, including finance and real-world asset tokenization.

Present data and forecasts related to the tokenization market growth and its implications.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Encourage trainees to consider the impacts of tokenization in the digital era and the evolving trends in DAM.

Relevant Readings

- Tarhini, Mahmoud. "Application of asset tokenization, smart contracts and decentralized finance in agriculture." Revista de Studii Financiare 6.10 (2021): 152-163.
- Wang, Gang, and Mark Nixon. "SoK: Tokenization on blockchain." Proceedings of the 14th IEEE/ACM International Conference on Utility and Cloud Computing Companion. 2021.
- "Token Economy: How Blockchain and Smart Contracts Revolutionize the Economy" by Shermin Vasumitr: This book explores the concept of tokenization and its impact on various industries, including the food supply chain. It covers topics such as token standards, decentralized finance, and the potential of blockchain-based token economies.
- "Blockchain: Blueprint for a New Economy" by Melanie Swan: This comprehensive book covers various aspects of blockchain technology, including tokenization and its applications across different industries. It provides insights into the potential benefits and challenges of implementing tokenization in real-world scenarios.

Additional readings can be found within each Lesson.

Course Provider - Contact Details

Comments and inquiries may be addressed to Evgenia Kapassa (kapassa.e@unic.ac.cy), University of Nicosia and Andreas Delladetsimas (delladetsimas.a@unic.ac.cy), University of Nicosia

Course #3: MiCA Regulation and CBDC

Content and Duration

The lessons provided with the course “MiCA Regulation and CBDCs” are as follows:

Lesson 1: Introduction to MiCA: Its origins, principles, and objectives.

Lesson 2: Detailed analysis of MiCA regulation: What does it mean for businesses and individuals dealing with crypto-assets.

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

Lesson 4: The impact of MiCA regulations and CBDCs on crypto-assets within the food supply chain.

Lesson 5: Case Studies of CBDCs

Approx. 4 hours to complete (including study time).

Objective

The objective of this course, named "MiCA Regulation and CBDC" is to provide an in-depth understanding of the Markets in Crypto Assets (MiCA) regulation and Central Bank Digital Currencies (CBDCs). The course begins with an introduction to MiCA, covering its origins, principles, and objectives. It then progresses to a detailed analysis of MiCA regulation, exploring its implications for businesses and individuals in the crypto-asset space. The course also introduces CBDCs, examining their rationale, functionality, and impact on the global economy. A significant focus is on the impact of MiCA and CBDCs on crypto-assets within the food supply chain, highlighted through real-world case studies. This comprehensive approach aims to equip learners with critical knowledge of MiCA and CBDCs, and their intricate relationship with the food supply chain.

Learning Outcomes

Participants of this course will gain knowledge about MiCA's origins, principles, objectives, and its unifying framework across the EU. They will learn to differentiate between various crypto-asset types and understand the obligations of crypto-asset issuers. The course also emphasizes the environmental accountability required under MiCA.

What your trainees will learn:

- Understand MiCA's Framework: Understand the primary components and goals of MiCA in the EU's financial regulatory landscape.
- Crypto-Asset Classification: Differentiate between various crypto-assets like utility tokens, asset-referenced tokens, and e-money tokens under MiCA.
- Issuer Responsibilities: Recognize the responsibilities of crypto-asset issuers, including white paper publication and authority submissions.
- MiCA's Stakeholder Impact: Understand MiCA's impact on stakeholders, focusing on protection, transparency, and environmental considerations.
- CBDC Fundamentals: Gain knowledge about what CBDCs are and how they differ from other currencies. Understand the reasons behind the emergence of CBDCs and their potential global acceptance. Additionally, learners will learn about the practicalities and challenges in developing CBDCs through case studies.
- Crypto vs. Traditional Payments: Differentiate between traditional and crypto payment methods in the food supply chain.

- Regulatory Role of MiCA: Understand MiCA's regulatory impact on crypto-assets in the food supply chain.
- CBDCs in the Food Supply Chain: Comprehend the role and impact of CBDCs in the food supply chain.
- Forecasting Future Trends: Predict future trends involving blockchain, MiCA, and CBDCs in the food supply chain. Moreover, learners in collaboration with the trainer will learn to speculate about future trends and developments in CBDCs based on current case studies.

Course Level – Education Level Required – Prerequisites

Advanced Level, Professional Development

Bachelor's Degree

Consider this course as an advanced level of "Course 1 – Introduction to Blockchain Technology and Digital Assets" & "Course 2 – Exploring Digital Asset Management and Tokenization".

Target Audience

Financial Professionals, Regulatory and Compliance Officers, Blockchain and FinTech Entrepreneurs, Legal Professionals, Academics and Researchers, Students in Finance and Technology, Supply Chain Professionals, Tech Enthusiasts.

Assessment – Certification of Attendance – Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through the emerging field MiCA Regulation and CBDCs in the food supply chain, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Given that this course is an advanced level of TrustFood Course #1 and Course #2, consider:

- Review and build upon the foundational knowledge from Course #1 and Course #2
- Utilize the provided course materials, such as detailed slides and interactive resources, to facilitate an immersive learning experience.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Visual Icebreakers: There are several visual “helpers” within the course that could help you stimulate the interest and discussions regarding MiCa. For example:

- You could use the image in Lesson 2, slide 18 to initiate a discussion about the future of MiCa.
- You could use images in Lesson 3, slide 9 and 10 to provide statistical data in regards to the bank of international settlement.
- You could use the image in Lesson 4, slide 15 to visually compare traditional payments versus blockchain payments.

Instant Storytelling: Ask participants to share a quick story or thought about a food product, focusing on aspects like origin or traceability. This can lead to discussions about how blockchain and digital currencies could play a role.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Lesson 1: Introduction to MiCA – Its origins, principles, and objectives

Begin the lesson by tracing the roots of MiCA (Markets in Crypto-Assets Regulation), explaining its inception, key principles, and objectives.

Use a timeline or flowchart to illustrate MiCA's development and key milestones.

Discuss the conditions and needs that led to MiCA's creation, especially focusing on the rise of crypto-assets and regulatory gaps.

Explain MiCA's significance in the EU's financial regulatory framework, including its aim to standardize regulations across EU countries.

Conclude the lesson with a summary of MiCA's role, its principles, and its expected impact on the crypto-assets market.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Engage participants with questions about MiCA's jurisdiction and its objectives. This helps to reinforce learning and ensure comprehension.

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

Start the lesson by providing an overview of MiCA, including its foundational pillars and potential impacts.

Highlight MiCA's objectives, including replacing various EU country regulations with a comprehensive framework and setting clear rules for crypto-asset service providers and token issuers.

Explain the different classifications of crypto-assets under MiCA, such as utility tokens, asset-referenced tokens (ARTs), and e-money tokens (EMTs). Discuss MiCA's approach to environmental accountability, requiring stakeholders to disclose their environmental and climate impacts.

Conclude the lesson by summarizing MiCA's significance, coverage, exclusions, and impact on stakeholders.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Incorporate questions to assess understanding, such as the scope of DeFi in MiCA and the application timeline of MiCA rules.

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

Begin with an introduction to what CBDCs are and their distinction from other digital and conventional currencies.

Discuss the reasons behind the development and potential adoption of CBDCs globally, such as the rise of digital payments and the decline in cash usage.

Explain how CBDCs function, covering topics like their issuance by central banks and their role in the financial system.

Assess the potential role of CBDCs in reshaping the global economy, focusing on aspects like cross-border transactions and financial inclusivity.

Discuss how central banks, like the European Central Bank, are approaching CBDCs, using the digital euro as an example.

Summarize the lesson by highlighting the defining features of CBDCs, their motivations, global implications, and the case study of the digital euro.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Encourage trainees to critically evaluate the benefits and potential drawbacks of CBDCs.

Lesson 4: The impact of MiCA regulations and CBDCs on cryptoassets within the food supply chain

Begin by outlining how blockchain technology, especially with MiCA regulations and CBDCs, is influencing the food supply chain.

Start with an introduction slide summarizing blockchain's role in the food supply chain and how MiCA and CBDCs fit into this context.

Explain the concept of tokenization in the context of the food supply chain, emphasizing its benefits like traceability and authenticity.

Discuss MiCA regulations and their implications for crypto-assets in the food supply chain, focusing on consumer protection, market integrity, and financial stability.

Cover the basics of Central Bank Digital Currencies, their potential impact on the food supply chain, and how they might streamline transactions.

Highlight the differences between traditional payment mechanisms and crypto payment methods, focusing on their implications within the food supply chain.

Conclude the lesson with a summary of how blockchain, MiCA, and CBDCs are reshaping the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Encourage critical assessment of the benefits and hurdles of integrating crypto-assets, particularly considering MiCA's influence.

Lesson 5: Case Studies of CBDCs

Start the lesson by revising the definition of Central Bank Digital Currencies (CBDCs) and their role in modern monetary systems.

Discuss the current scenario of CBDCs in the global financial landscape, highlighting various countries' involvement.

Explore CBDC initiatives in regions such as the European Union, United States, China, and the United Kingdom, detailing each project's status and unique approaches.

Discuss how CBDCs can reshape and influence global economies, both positively and negatively.: Summarize the key points of the lesson, emphasizing the definition, global initiatives, and real-world case studies of CBDCs.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Relevant Readings

- EU, European Commission (2020). Official communication on the Digital Finance Package. Available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_20_1684 (Accessed on 17/10/2023).
- EUR-Lex (2020). Proposal for a Regulation on Markets in Crypto-Assets. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/?qid=1600946099150&uri=CELEX:52020PC0593 (Accessed on 17/10/2023).
- European Parliament (Y2020). Procedure file on MiCA. Available at: https://oeil.secure.europarl.europa.eu/oeil/popups/ficheprocedure.do?reference=2020/0265(COD)&l=en (Accessed on 17/10/2023).
- European Parliament (2023). Legislative resolution of 20 April 2023 on the proposal for a regulation of the European Parliament and of the Council on Markets in Crypto-assets and amending Directive (EU) 2019/1937 (COM(2020)0593 – C9-0306/2020 – 2020/0265(COD)) . Available at: https://www.europarl.europa.eu/doceo/document/TA-9-2023-0117_EN.html (Accessed on 17/10/2023).
- European Parliament and the Council (2023). REGULATION (EU) 2023/1114 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 31 May 2023. Available at: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1114 (Accessed on 17/10/2023).
- European Securities and Markets Authority (ESMA), no date. Markets in Crypto-Assets Regulation (MiCA). (online) Available at: https://www.esma.europa.eu/esmas-activities/digital-finance-and-innovation/markets-crypto-assets-regulation-mica (Accessed 17 October 2023)
- ESMA (2023) 'ESMA clarifies timeline for MiCA and encourages market participants and NCAs to start preparing for the transition', ESMA74-449133380-441, available at: https://www.esma.europa.eu/sites/default/files/2023-10/ESMA74-449133380-441_Statement_on_MiCA_Supervisory_Convergence.pdf (Accessed on 18/10/2023).

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

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Course #4: Financial Technology (FinTech) with Example Applications in Food Supply Chain

Content and Duration

The lessons provided with the course "Financial Technology (FinTech) with Example Applications in Food Supply Chain" are as follows:

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

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

Lesson 3: The Interplay Between FinTech and the Food Supply Chain

Lesson 4: Key FinTech applications in the food supply chain:

Lesson 5: Exploring Real-world Implementations

Lesson 6: Future Trends

Approx. 4 hours to complete (including study time).

Objective

The objective of Course #4: Financial Technology (FinTech) with Example Applications in the Food Supply Chain is to provide a thorough understanding of FinTech, its core components, and its transformative applications in various sectors, particularly focusing on the agrifood sector. The course aims to explore the influence of FinTech innovations on the food supply chain, highlighting how technologies such as blockchain, AI, data analytics, digital payments, and smart contracts enhance efficiency, traceability, and transaction management. Participants will engage in assessing real-world case studies to understand the practical implementation of these technologies in the agrifood sector. Furthermore, the course will investigate the future trends in FinTech, providing insights into upcoming developments that could significantly impact the agrifood industry.

Learning Outcomes

What your trainees will learn:

- Understand the Foundational Concepts and Terminology of FinTech: Gain an understanding of basic FinTech concepts, terminology, and integration of technology in financial services.
- Understand Transparency and Traceability in Agrifood: Comprehend how FinTech enhances transparency and traceability in the agrifood supply chain, focusing on the role of digital assets.
- Recognize the Importance of Cost Efficiency: Learn about cost efficiency's significance in the agrifood supply chain and how digital assets contribute to expense reduction.
- Identify Challenges and Opportunities in FinTech: Discuss general and sector-specific challenges in FinTech, alongside opportunities and solutions it presents.
- Role of FinTech in Agrifood Sector: Comprehend how FinTech enhances financial transactions, data management, and traceability within the supply chain.
- Identify Key FinTech Applications in Agrifood: Explain different FinTech applications crucial in the agrifood sector for financial inclusion and business innovation.
- Understand the Benefits of Digital Payments and AI: Recognize how digital payments and AI improve efficiency, forecasting, safety, and sustainability in agrifood.
- Understand FinTech Evolution: Discuss the evolution of FinTech, focusing on emerging trends in the agrifood sector and understand how innovative FinTech tools could reshape the financial landscape of the agrifood sector.

Course Level, Education Level Required, and Prerequisites

Intermediate Level, Professional Development

Minimum education level required: Bachelor’s Degree

Consider this course as an advanced level of Course #1: “Introduction to Blockchain Technology and Digital Assets”.

Target Audience

Professionals in the Agrifood Industry, FinTech Entrepreneurs and Innovators, Supply Chain Managers, Financial and Banking Professionals, Academics and Researchers, Students in Related Fields

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through the emerging field of FinTech, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Visual Icebreakers: There are several visual “helpers” within the course that could help you stimulate the interest and discussions regarding FinTech with example applications in food supply chain. For example:

- You could provide an introduction to FinTech through the video presented in Lesson 1 , slide 7.
- You could use the diagram in Lesson 1, slide 20 to discuss the main advantages of FinTech, as well as the diagram in Lesson 2, slide 19 to present its benefits for the agrifood sector in particular.
- You could stimulate the interest by presenting the video available in Lesson 3, slide 23, which discusses in detail the integration of blockchain, FinTech and the food industry.
- You could lavarage the step-by-step diagram presented in Lesson 4, slide 15, in order to explain how the executions of transactions are made through smart contracts.

Instant Storytelling: Ask participants to share a quick story or thought about a food product, focusing on aspects like origin or traceability. This can lead to discussions about how blockchain and digital currencies could play a role.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

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

Begin the lesson by defining FinTech, including its key components and how it integrates technology into financial services.

Explain the technologies driving FinTech, such as blockchain, AI, and cloud computing. Highlight how these technologies contribute to the FinTech ecosystem.

Discuss how FinTech enhances efficiency, transparency, and sustainability in the agrifood supply chain. Cover both the benefits and challenges of FinTech, including operational risks and environmental concerns.

Conclude the lesson with a summary of FinTech's role in transforming the financial landscape, emphasizing its user-centric approach and efficiency.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

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

Begin with an overview of how FinTech is revolutionizing various industries, with a special focus on the agrifood sector.

Discuss the disruptive innovations FinTech has introduced in sectors like healthcare, finance, retail, and manufacturing.

Focus on FinTech's applications in the agrifood sector, elucidating how it addresses unique challenges in this field.

Summarize the lesson by re-iterating FinTech's broad applications and its pivotal role in the agrifood sector.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Encourage participants to identify general and agrifood-specific challenges in FinTech, along with the opportunities and solutions it presents.

Include questions to assess participants' understanding of FinTech's impact on various sectors, especially agrifood.

Lesson 3: The Interplay Between FinTech and the Food Supply Chain

Start with an overview of how FinTech enhances the agrifood supply chain, focusing on streamlining financial transactions, improving data management, and boosting product traceability.

Use the opening slides to set the stage for FinTech's integral role in the agrifood sector, highlighting key aspects like transaction efficiency, data analytics, and traceability.

Explain concepts like Supply Chain Finance (SCF) and AgriFinTech, detailing how they specifically cater to the agricultural sector.

Discuss the ways FinTech streamlines transactions, enhances data management, and supports risk management in the food supply chain.

Cover how FinTech supports sustainable practices and risk assessment in the food supply chain. Conclude the lesson by summarizing FinTech's multifaceted role in enhancing the agrifood supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 4: Key FinTech applications in the food supply chain

Begin with an overview of how blockchain, AI, and digital payments are revolutionizing the agrifood supply chain.

Explain blockchain's fundamentals and its applications in agrifood, focusing on transparency and traceability.

Discuss the role of smart contracts in automating agrifood transactions and the benefits of digital payments in supply chain management.

Cover AI's role in demand forecasting and inventory management in the agrifood sector.

Address the challenges of integrating FinTech solutions, such as system compatibility and regulatory hurdles.

Conclude with a summary, emphasizing the transformative potential of FinTech within the agrifood supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage participants with questions to assess their understanding of these technologies in the agrifood supply chain.

Lesson 5: Exploring Real-world Implementations

Start by setting the scene for the lesson, focusing on how FinTech solutions like IBM Food Trust, Beefledger, and ProducePay are revolutionizing agriculture.

Discuss each case study, highlighting how these platforms address specific agricultural challenges and their impacts on supply chain efficiency, transparency, and stakeholder trust.

Explain the role of blockchain in agriculture, digital platforms, and marketplaces, and address the common challenges in FinTech.

Dive deep into each case study, exploring their functionalities, added value, and the core challenges they address.

Summarise the lesson by summarizing the transformative impact of FinTech in agriculture and the key challenges that need navigation.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage the learners with a question to evaluate their understanding of the challenges in FinTech implementations and potential solutions.

Lesson 6: Future Trends

Start by outlining the emerging trends in FinTech and their potential influence on the agrifood sector.

Discuss how evolving FinTech solutions can specifically transform agrifood processes, optimizing financial operations and stakeholder interaction. Provide examples or case studies illustrating FinTech's impact on agrifood processes.

Explain the role of technologies like AI, blockchain, and digital currencies in shaping the future of finance and their adoption in the agrifood sector.

Summarize the lesson by highlighting the anticipated evolution of FinTech and its potential to revolutionize the agrifood sector.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage the learners with a question to evaluate their understanding of the challenges in FinTech implementations and potential solutions.

Relevant Readings

- Kagan, J. (2023) Financial Technology (Fintech): Its uses and impact on our lives, Investopedia. Available at: https://www.investopedia.com/terms/f/fintech.asp
- Neil, C. (2021). How Fintech is driving the new age of retail agility, FinTech Futures. Available at: https://www.fintechfutures.com/2021/12/how-fintech-is-driving-the-new-age-of-retail-agility/
- Phukan, P.K. (2023) Financial Technology (FinTech) and Sustainability, LinkedIn. Available at: https://www.linkedin.com/pulse/financial-technology-fintech-sustainability-dr-pranjal-kumar-phukan/
- Pothula, S.R., 2023. Review and analysis of FinTech approaches for smart agriculture in one place. Journal of Agriculture, Science and Technology, 22(1), pp.60-69.
- Anshari, M., Almunawar, M.N., Masri, M. and Hamdan, M., 2019. Digital marketplace and FinTech to support agriculture sustainability. Energy Procedia, 156, pp.234-238.

Additional readings can be found within each Lesson's presentation.

Course Provider - Contact Details

Comments and inquiries may be addressed to Andreas Delladetsimas (delladetsimas.a@unic.ac.cy) and Evgenia Kapassa (kapassa.e@unic.ac.cy), University of Nicosia

Course #5: Tokenization with Example Applications in Food Supply Chain

Course Content and Duration

The lessons provided with the course "Tokenization with Example Applications in Food Supply Chain" are as follows:

Lesson 1: Introduction to Tokenization

Lesson 2: The role of blockchain in tokenization

Lesson 3: Different types of tokens

Lesson 4: Tokenization in Food Supply Chain

Lesson 5: Exploring Real-world Implementations

Lesson 6: Future Trends

Approx. 4 hours to complete (including study time).

Objective

The objective of Course 5: "Tokenization with Example Applications in Food Supply Chain" is to provide a understanding of tokenization, its applications and its role in various industries, with a special focus on the food supply chain. The course is designed to guide learners through the fundamental concepts of tokenization, explaining how it works, and the benefits and challenges associated with it. It describes the integral role of blockchain technology in enabling secure and transparent tokenization and explores different types of tokens, including governance, utility, security, platform, and non-fungible tokens (NFTs). Additionally, the course highlights how tokenization can be applied specifically in the food supply chain, enhancing traceability, verifying food safety, and improving transparency and accountability in sourcing and delivery. Learners will also have the opportunity to examine real-world implementations of tokenization and look ahead to future trends, gaining insights into how this technology could continue to evolve and impact the food supply chain.

Learning Outcomes

What your trainees will learn:

1. Understanding Tokenization: Define and explain the concept of tokenization, along with describing its basic process.
2. Benefits and Challenges of Tokenization: List and understand the benefits and challenges associated with tokenization.
3. Blockchain's Fundamentals: Describe the foundational principles of blockchain technology.
4. Blockchain in Tokenization: Explain how blockchain facilitates secure and transparent tokenization and understand its benefits from smart contracts and consensus algorithms.
5. Differentiating Token Types: Differentiate between various types of tokens, including their distinct features and applications, especially in the agrifood sector.
6. Tokenization in Food Safety: Recognize the transformative potential of tokenization in ensuring food safety, authenticity, and traceability.
7. Addressing Food Supply Chain Challenges: Identify key challenges in the food supply chain that tokenization can address and understand the practical implementation of tokenization in overcoming these challenges.
8. Case Studies and Future Trends in Tokenization: Examine real-world case studies to understand the advantages and outcomes of tokenized systems. Additionally, investigate future trends in tokenization applied in the food supply chain.

Course Level, Education Level Required, and Prerequisites

Intermediate Level

Bachelor's Degree

Consider this course as an advanced level of "Course 1 - Introduction to Blockchain Technology and Digital Assets" & "Course 2 - Exploring Digital Asset Management and Tokenization".

Target Audience

Professionals in the Agrifood Industry, FinTech and Blockchain Enthusiasts, Technology Developers and Entrepreneurs, Academic Researchers and Students

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through the emerging field of tokenization, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Visual Icebreakers: There are several visual "helpers" within the course that could help you stimulate the interest and discussions regarding FinTech with example applications in food supply chain. For example:

- You could provide an introduction to tokenization through the video presented in Lesson 1 , slide 5.
- You could use the image in Lesson 1. Slide 10, to explain how tokenization works in agrifood.
- You could encourage the course participants to watch the video available in Lesson 2, slide 5 to gain an overall understanding of the blockchain basics, as well as the video available in Lesson 3, slide 7, to gain a deeper knowledge in regards to blockchain layers.
- You could use video is Lesson 3, slide 10 to help you discuss about the governance tokens, the video in Lesson 3, slide 12 to discuss about utility tokens, the video in Lesson 3, slide 14, to discuss security tokens, and the one available in lesson 3, slide 17 to discuss about NFTs.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Lesson 1: Introduction to Tokenization

Begin by defining tokenization and explaining its operational process. Emphasize how tokenization replaces sensitive data with non-sensitive tokens.

Discuss tokenization's application in the agrifood sector, focusing on how it enhances traceability, transparency, and safety.

Cover both the advantages and the potential challenges of implementing tokenization, including technological barriers and cost considerations.

Explain how tokenization differs from techniques like encryption and hashing.

Conclude with a summary of tokenization's role in enhancing security, traceability, and decentralization, along with its challenges.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 2: The role of blockchain in tokenization

Begin by establishing the symbiotic relationship between blockchain and tokenization, highlighting blockchain's foundational role in modern tokenization.

Use the introduction slide to explain how blockchain technology underpins tokenization, particularly in the agrifood sector.

Clarify key blockchain concepts, such as decentralization, immutability, and transparency.

Discuss blockchain's function in creating and validating tokens, ensuring security and transparency in token transactions.

Explain how smart contracts on blockchain platforms automate and regulate token transactions.

Cover different consensus mechanisms like Proof of Work and Proof of Stake, emphasizing their importance in validating and securing transactions on the blockchain.

Identify and discuss challenges like scalability, energy consumption, integration with existing systems, and regulatory uncertainties.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Engage the learners with a question to assess their understanding of why blockchain is considered suitable for tokenization.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 3: Different types of tokens

Begin by defining the concept of a token on the blockchain and then delve into explaining the different types of tokens such as governance, utility, security, platform, and NFTs.

Discuss each token type in detail, focusing on their characteristics, purposes, and how they function within blockchain ecosystems.

Relate each type of token to its potential applications in the agrifood sector, emphasizing how they can address specific industry challenges.

Conclude the lesson by summarizing the key aspects of different token types and their significance in blockchain applications, particularly in the agrifood sector.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 4: Tokenization in Food Supply Chain

Start with an introduction to how tokenization can be applied in the food supply chain for improved traceability, transparency, and efficiency.

Highlight the benefits of tokenization in the food supply chain, such as enhanced traceability, increased transparency, reduced counterfeiting, efficient recalls, and fair compensation for producers.

Explain how different types of tokens, such as quality certifications, can be used in the food supply chain. Identify various stakeholders in the food supply chain, such as farmers, distributors, retailers, and consumers, and discuss how tokenization impacts them.

Discuss the challenges of implementing tokenized systems, such as integration with existing systems, cost implications, and data privacy concerns.

Conclude with a summary of the role of tokenization in revolutionizing the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive. Include question(s) to assess participants' understanding of how tokenization enhances food safety.

Lesson 5: Exploring Real-world Implementations

Begin the lesson by emphasizing the practical side of tokenization in the food supply chain, showcasing actual applications.

Explore specific case studies that demonstrate how tokenization improves transparency, authenticity, and equity in the food system. Discuss the challenges faced by the food industry and how tokenization provides practical solutions.

Explain the benefits of tokenization for different stakeholders in the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 6: Future Trends

Begin by providing an overview of the anticipated growth and emerging applications of tokenization in the agrifood sector.

Explain the growth trajectory of the tokenization market and its expanding role in digital economies.

Discuss the new and innovative ways tokenization could be used in the agrifood sector, enhancing consumer engagement and operational efficiency.

Address potential regulatory concerns, standardization needs, and technological constraints that may arise with the advancement of tokenization.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Relevant Readings

- Swan, Melanie. Blockchain: Blueprint for a new economy. "O'Reilly Media, Inc.", 2015.
- Lee, Jei Young. "A decentralized token economy: How blockchain and cryptocurrency can revolutionize business." Business Horizons 62.6 (2019): 773-784.

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

Comments and inquiries may be addressed to Evgenia Kapassa (kapassa.e@unic.ac.cy), University of Nicosia

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

Content and Duration

The lessons provided with the course "Introduction to Blockchain in the Food Supply Chain: Building Trust and Ensuring Safety" are as follows:

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

Lesson 2: Blockchain Technology Essentials – Part I

Lesson 3: Blockchain Technology Essentials – Part II

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

Lesson 5: Blockchain for trust-building in the food supply chain

Lesson 6: Ensuring Food Safety through Blockchain

Lesson 7: Exploring Real-world Implementations

Lesson 8: Future Trends

Approx. 6 hours to complete (including study time).

Objective

The objective of Course #6, “Introduction to Blockchain in the Food Supply Chain: Building Trust and Ensuring Safety” is to provide participants with an understanding of blockchain technology and its applications in the food supply chain. This course aims to describe how blockchain can enhance transparency, improve food safety and foster trust among various stakeholders within the food supply chain. Participants will be guided through a journey that starts with understanding the essentials of the food supply chain and the challenges faced by its stakeholders. The course will also discuss the core principles of blockchain technology, its key features such as immutability and decentralization, and the different types of blockchain, including their advantages, disadvantages, and real-world applications. The course will also explore how blockchain’s inherent characteristics can be leveraged to build trust among food supply chain stakeholders and ensure food safety, underlined by real-world examples. Finally, the course will conclude by examining real-world implementations of blockchain in the food supply chain through case studies and future trends in the field.

Learning Outcomes

What your trainees will learn:

- Comprehend Food Supply Chain: Understand the design, key stages, and stakeholders of the food supply chain from agricultural sources to end-users.
- Identify the Stakeholders: Identify primary and secondary stakeholders in the food supply chain, understanding their roles and impacts.
- Recognize Supply Chain Challenges: Acknowledge the obstacles faced in the food supply chain, including logistical issues and quality control.
- Understand Blockchain Basics: Recognize the key elements of blockchain technology, its data storage method, and the significance of its tamper-evident nature.
- Blockchain in Food Supply Chain: Identify blockchain attributes that address challenges in the food supply chain.
- Blockchain for Trust-Building: Understand blockchain's role in enhancing trust, transparency, and authenticity in the food supply chain.

- Blockchain for Food Safety: Identify how blockchain enhances food traceability and safety, including real-world case studies.
- Blockchain Solutions to Industry Challenges: Recognize how blockchain addresses key challenges in the food supply industry.
- Future Trends in Blockchain: Understand future trends and the evolving significance of blockchain in the food supply chain.

Course Level - Education Level Required - Prerequisites

Beginners Level

Bachelor's Degree

n/a

Target Audience

Food Industry Professionals, Supply Chain Managers and Logistics Experts, Food Safety Regulators and Policy Makers, Technology Professionals with an Interest in Agri-tech, Agricultural Entrepreneurs and Innovators, Food Industry Consultants and Advisors, Academics and Researchers in Food Technology and Blockchain, Students in Food Science, Supply Chain Management and Technology.

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through this course, this handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Visual Icebreakers: There are several visual "helpers" within the course that could help you stimulate the interest and discussions regarding blockchain in FSC. For example:

- You could initialize this course by presenting a TEDx talk, available in Lesson 1, slide 10.
- You could use the diagram in Lesson 1, slide 25 to present in a visual way the challenges that FSC is currently facing.
- You could use the diagram presented in Lesson 4, slide 7 to discuss the impact of blockchain in FSC.
- You could present and initiate a discussion about the upcoming trends in blockchain for FSC based on the image present in Lesson 8, slide 5.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Storytelling with Case Studies: Incorporate relevant stories or case studies that illustrate key concepts in a practical context, making the content more relatable and memorable.

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

Start the lesson by giving an overview of the food supply chain, its key stages, and the primary stakeholders involved. Discuss the roles and responsibilities of primary and secondary stakeholders in the food supply chain.

Identify common challenges within the food supply chain, including logistical problems, quality control, and inventory management.

Conclude with a summary of the critical aspects of the food supply chain and its challenges.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 2: Blockchain Technology Essentials – Part I

Begin by explaining blockchain's core concept as a digital ledger and its role in recording transactions in a tamper-proof way.

Focus on blockchain's key features, such as decentralization, immutability, and the use of hash functions.

Explain concepts like SHA-256 and how they contribute to blockchain's security and integrity.

Discuss how decentralization in blockchain enhances security and transparency and eliminates single points of failure. Explain the importance of immutability in maintaining the reliability and integrity of data on the blockchain.

Provide an understanding of how blockchain works, including transaction recording in blocks and the linking of these blocks.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive. Include interactive questions to assess participants' understanding of blockchain's key features and how they contribute to its robustness.

Lesson 3: Blockchain Technology Essentials – Part II

Begin by explaining the various types of blockchain, including public, private, consortium, and hybrid blockchains, highlighting their unique characteristics.

Discuss the strengths and weaknesses of each blockchain type, helping participants understand their suitability for different scenarios.

Use case studies or examples to illustrate the application of different blockchain types in real-world scenarios.

Conclude with a summary of the diverse types of blockchains and their implications for the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Encourage active participation through questions about how different blockchain types can be applied in the food supply chain.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

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

Emphasize the transformative potential of blockchain in addressing challenges such as traceability, transparency, efficiency, and sustainability in the agrifood sector.

Discuss core blockchain concepts like transparency, traceability, efficiency, cost savings, fraud prevention, and stakeholder engagement.

Discuss how blockchain can accelerate decision-making, reduce costs, automate processes, optimize logistics, and enhance data integrity.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage learners with formative assessment questions to evaluate their understanding of blockchain's role in enhancing efficiency and other aspects within the food supply chain.

Lesson 5: Blockchain for trust-building in the food supply chain

Start the lesson by emphasizing blockchain's capacity to build trust in the food supply chain. Highlight issues with traditional traceability methods and how blockchain offers an alternative.

Explain how blockchain's properties like immutability and transparency contribute to trust-building among all stakeholders. Discuss the limitations of traditional systems in ensuring transparency and authenticity in the food supply chain.

Assess participants' understanding of blockchain's trust-building features and how they impact the food supply chain.

Conclude the lesson by summarizing how blockchain's immutable and transparent nature fosters a reliable environment for all parties involved.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 6: Ensuring Food Safety through Blockchain

Start by highlighting the importance of blockchain technology in enhancing food safety, from preventing contamination to ensuring the integrity of the food supply.

Explain how blockchain aids in rapid tracking of food products, effective management of recalls, and maintaining the integrity of food safety data.

Provide real-world examples or case studies showing how blockchain technology is applied in food safety.

Conclude by summarizing how blockchain technology acts as a safety protocol in the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive. Assess learners' understanding with a question on how blockchain technology aids in identifying and resolving food safety issues.

Provide additional resources for those interested in exploring the topic further.

Lesson 7: Exploring Real-world Implementations

Start by highlighting the relevance of blockchain technology in practical scenarios within the food supply chain.

Present various case studies that showcase the integration of blockchain in the food supply chain. Focus on how blockchain solves specific problems like traceability, safety, and sustainability.

Encourage discussion on the challenges faced in these implementations and the blockchain solutions applied.

Engage participants with formative assessments to understand how blockchain addresses industry issues.

Provide additional resources for those interested in exploring the topic further.

Lesson 8: Future Trends

Start by setting the stage for the anticipated advancements in blockchain technology within the food supply chain. Focus on the importance of staying informed about upcoming trends.

Highlight key emerging trends such as enhanced end-to-end visibility, IoT and real-time tracking, and consumer engagement through blockchain technology.

Discuss the potential advancements in blockchain technology, such as improved scalability, interoperability, and energy efficiency.

Assess participants' understanding of how blockchain technology might evolve to better serve the food industry in the future.

Provide a list of additional resources for participants interested in further exploring the topic.

Relevant Readings

- Zhao, Guoqing, et al. “Blockchain technology in agri-food value chain management: A synthesis of applications, challenges and future research directions”, Computers in industry 109 (2019): 83-99.
- Ehsan, Ibtisam, et al. “A conceptual model for blockchain-based agriculture food supply chain system”, Scientific Programming 2022 (2022): 1-15.
- Li, Kunpeng, Jun-Yeon Lee, and Amir Gharehgozli. “Blockchain in food supply chains: A literature review and synthesis analysis of platforms, benefits and challenges”, International Journal of Production Research 61.11 (2023): 3527-3546.

Additional readings can be found within each Lesson’s presentation.

Course Provider - Contact Details

Comments and inquiries may be addressed to Andreas Delladetsimas (delladetsimas.a@unic.ac.cy) and Evgenia Kapassa (kapassa.e@unic.ac.cy), University of Nicosia

Course #7: Basic Blockchain Skills

Content and Duration

The lessons provided with the course “Basic Blockchain Skills” are as follows:

Lesson 1: Hash Functions

Lesson 2: Understanding Cryptocurrency Transactions

Lesson 3: Block Structure and Blockchain Connection

Lesson 4: Nonce #

Lesson 5: Block Explorers

Lesson 6: UTXO Transaction Model

Lesson 7: Seed Phrase, Private Key, and Address

Approx. 4.5 hours to complete.

Objective

The course 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.

Learning Outcomes

What your trainees will learn:

- 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.

Course Level - Education Level Required – Prerequisites

Beginners, Professional Development or Continuing Education

High School Diploma or Equivalent

Economics basic

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees and food supply chain personnel

Assessment - Certification of Attendance – Badges

The assessment for this course is realized with the corresponding quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

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

This lesson dives into the hash functions and their role in blockchain.

Delivery & Engagement: Start with a relatable analogy: Explain hash functions like "secret codes" for data, using the "Summary & Key Takeaways" section for inspiration.

Interactive Activities: Use questions throughout the lesson to test understanding (e.g., "What happens to the blockchain if a hash is changed?").

Consider a group activity where students simulate a blockchain with paper blocks and hash functions.

Focus on Core Concepts: Emphasize the key properties of hash functions (deterministic, one-way, collision resistance) and how they relate to blockchain security.

Simplify Complexity: Break down complex processes like "how hash functions work" into smaller, more manageable steps.

Case Studies: Briefly discuss case studies (Bitcoin & SHA-256, Ethereum & SHA-3) but prioritize broader understanding over technical specifics.

Tailor Difficulty: Gauge student background and adjust the depth of explanation for different types of hash functions (MD5 vs. SHA-2 vs. Keccak).

Digital Signature Connection: Briefly explain digital signatures within the context of hash functions, referencing the "Digital Signature Generation" section.

Formative Assessment & Conclusion: Encourage questions throughout the lesson and address student misconceptions.

Reinforce Key Points: Briefly summarize the learning objectives and takeaways at the end, revisiting the "Conclusion" section.

Connect the Dots: Emphasize the importance of hash functions as the foundation for blockchain security and transparency.

Lesson 2: Understanding Cryptocurrency Transactions

This lesson delves into the Understanding cryptocurrency transaction.

Engagement & Clarity: Start with a Real-World Example: Briefly showcase a scenario of how cryptocurrency transactions can be used in daily life (e.g., buying coffee).

Interactive Activities: Include quizzes or polls throughout the lesson to check understanding (e.g., "True or False: All cryptocurrency transactions are public").

Break Down Complexities: Use clear and concise language when explaining technical aspects like blockchain and mining.

Content & Structure: Focus on Core Concepts: Emphasize the key features of cryptocurrency transactions (transparency, security, efficiency) and how they differ from traditional transactions.

Separate Public vs. Private Blockchains: Dedicate separate sections to explain public and private blockchains with clear examples.

Simplify Transaction Process: Break down the steps involved in creating and sending a cryptocurrency transaction into smaller, manageable parts.

Focus on Popular Options: Briefly mention different types of wallets and exchanges but prioritize explaining popular and secure options.

Beware of Jargon: Minimize technical jargon and explain any necessary terms clearly within the context of the lesson.

Security & Awareness: Highlight Common Scams: Dedicate ample time to explaining prevalent cryptocurrency scams (ICOs, pump & dump, phishing) and emphasize protective measures.

Wallet Security Tips: Provide clear advice on using strong passwords, two-factor authentication, and choosing reputable wallets.

Future Outlook: Discuss the potential of cryptocurrency transactions and address ongoing challenges (scalability, regulation).

Lesson 3: Block Structure and Blockchain Connection

This lesson dives into the block structure and blockchain connection.

Block Diagram: Utilize a block diagram where students can explore components of a block and their connections (Slides#4-7)

Real-World Use Case Examples: Briefly showcase real-world applications of each consensus mechanism (e.g., PoW for Bitcoin, PoS for Ethereum).

Focus on Core Concepts: Emphasize the structure of a block (header vs. body) and the role of each component in ensuring security and integrity.

Block Analogy: Start by using a real-world analogy to explain a block. For example, compare it to a page in a ledger where each page holds transaction records (body) and a unique page number/reference to the previous page (previous block hash) for easy referencing and tamper detection.

Immutability: Reinforce the concept of immutability by explaining how changing data in a block would require altering all subsequent blocks due to the chaining with previous block hashes.

Cryptographic Hashing: Provide a basic explanation of cryptographic hashing functions and how they ensure data integrity within blocks. You can use a simple analogy like a fingerprint to represent a unique hash for each block.

Merkle Tree in Detail: Dedicate more time to explaining Merkle trees. Use diagrams to illustrate how transactions are hashed together and condensed into the Merkle root, allowing for efficient verification of individual transactions without needing to check the entire block.

Maintain Consistent Terminology: Use consistent terms throughout the lesson to avoid confusion (e.g., "block" vs. "block chain").

Lesson 4: Nonce

This lesson delves into the Nonce.

Simple Analogy: Start with a basic analogy to explain nonce. For example, compare it to a one-time use password used for online transactions, highlighting its role in preventing reuse.

Terminology Distinction: Briefly clarify the difference between "nonce" in cryptography (one-time use number) and its unrelated meaning in British English.

Interactive Hashing Simulation: Use an online tool or create a simplified simulation to demonstrate how changing the nonce value alters the resulting hash output.

Real-World Mining Example: Briefly showcase a simplified version of the mining process, highlighting how miners adjust the nonce to find a valid hash within the PoW difficulty range.

Double-Spending Prevention: Dedicate time to explaining double-spending and how nonce plays a crucial role in preventing it within the PoW system.

Scalability Challenges: Discuss the impact of nonce-based PoW on scalability and how alternative consensus mechanisms might address these issues.

Evolving Role: Briefly discuss potential future scenarios where the role of nonce might change due to advancements in consensus mechanisms or cryptography.

Enduring Significance: Emphasize that despite potential changes, the concept of a unique identifier and its use in cryptographic processes will likely remain relevant in blockchain technology.

Lesson 5: Blockchain Explorers.

This lesson delves into the Blockchain Explorers.

Live Exploration: Dedicate time for students to explore a real-time blockchain explorer (e.g., Etherscan) together. Guide them through key functionalities like transaction search, address lookup, and block inspection.

Interactive Search: Provide a list of sample transaction IDs or wallet addresses and have students use the explorer to find them. Explain the information displayed for each.

Industry-Specific Examples: Provide concrete examples of how blockchain explorers are used in different industries (e.g., tracking supply chains, analyzing cryptocurrency investments).

Interactive Case Study: Present a simplified case study (e.g., tracing a fraudulent transaction) and have students use a blockchain explorer to follow the steps involved in the investigation.

Emerging Capabilities: Briefly discuss potential future advancements in blockchain explorers, such as real-time network monitoring, predictive analytics, and integration with other blockchain applications.

Lesson 6: UTXO Transaction Model.

This lesson delves into the UTXO Transaction Model.

Interactive Transaction Simulation: Guide students through a simulated transaction using a simplified UTXO model. Incorporate concepts like input/output selection, change generation, and double-spending prevention.

Real-World Wallet Examples: Showcase how popular cryptocurrency wallets (e.g., Electrum, Coinbase) handle UTXOs behind the scenes. Discuss how users can view and manage their UTXOs within these wallets.

UTXO Scripting (Concise): Briefly introduce the concept of UTXO scripting for controlling UTXO spending conditions (e.g., multi-signature transactions). Emphasize its role in security but avoid getting into complex scriptwriting details.

Use Slide #10 to highlight key differences between the UTXO model and the account-based model (e.g., tracking method, double-spending prevention).

Glossary of Terms: Provide a glossary of terms used throughout the lesson, including UTXO, transaction input/output, double-spending, immutability, and block explorer.

Course Resources: Offer a list of online resources for students who want to delve deeper into specific technical aspects of the UTXO model or explore popular UTXO-based blockchains.

Lesson 7: Seed Phrase, Private Key and Address.

This lesson delves into the Seed Phrase, Private Key and Address.

Focus on Core Concepts and Real-World Use: Interactive Seed Phrase Generation: Guide students through a simulated seed phrase generation process. Emphasize randomness and the importance of secure storage (avoiding digital storage).

Wallet Recovery Demonstration: Showcase how to recover a lost wallet using a seed phrase on a popular software wallet (e.g., Electrum). Briefly discuss hardware wallet recovery as an alternative (optional).

Hashing Function Visualization: Briefly explain the concept of hashing functions using a simplified analogy (e.g., scrambling an email to create a unique ID). Demonstrate how it protects private keys from the address.

Security Best Practices and Phishing Awareness:

Phishing Simulation: Simulate a phishing attempt where a fake website tries to trick users into revealing their seed phrase. Discuss red flags and how to avoid such scams.

Strong Password for Software Wallets: Highlight the importance of using strong passwords for software wallets even when using seed phrases (protects against malware).

Mnemonic vs. Private Key Trade-Offs: Briefly discuss the trade-offs between seed phrase memorability (mnemonic) and private key direct control.

Relevant Readings

"Mastering Bitcoin" by Andreas M. Antonopoulos: This book provides a comprehensive introduction to Bitcoin and blockchain technology, covering key concepts such as hash functions, block structure, transactions, and security.

"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher: This book offers a beginner-friendly approach to understanding blockchain technology, covering topics like hashing, block structure, consensus algorithms, and smart contracts.

"Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies is Changing the World" by Don Tapscott and Alex Tapscott: This book explores the potential impact of blockchain technology across various industries and provides insights into its transformative power.

"Mastering Blockchain: Unlocking the Power of Cryptocurrencies, Smart Contracts, and Decentralized Applications" by Imran Bashir: This advanced book delves deeper into

blockchain technology, covering topics such as cryptographic hash functions, consensus mechanisms, privacy, and scalability.

Course Provider - Contact Details

Comments and inquiries may be addressed to Leonid Khatskevych and Roman Kravchenko, 482.solutions - hello@482.solutions

Course #8: Advanced Blockchain Skills

Content and Duration

The lessons provided with the course “Advanced Blockchain Skills” are as follows:

Lesson 1: Crypto Wallets

Lesson 2: Blockchain Test Nets

Lesson 3: Test Net Faucets

Lesson 4: Smart Contracts

Lesson 5: Multi-Signature Transactions

Lesson 6: Security Considerations

Approx. 3 hours and 45 minutes to complete.

Objective

This course equips learners with a comprehensive understanding of advanced blockchain concepts and their practical applications. They will gain a thorough grasp of:

Complex blockchain architectures and their underlying mechanisms.

Various types of crypto wallets and their functionalities (custodial vs non-custodial, hot vs cold storage, hardware wallets).

Test nets and test net faucets for secure experimentation.

Smart contract fundamentals, including hands-on token creation on the Ethereum test net using Remix IDE.

The basics of multi-signature transactions using Gnosis Safe for enhanced security.

Learning Outcomes

What your trainees will learn:

- Understand advanced blockchain concepts and architectures
- Master different crypto wallet types (custodial/non-custodial, hot/cold storage, hardware)
- Utilize test nets and faucets for experimentation
- Basic understanding of smart contracts
- Implement multi-signature transactions for security

Course Level - Education Level Required – Prerequisites

Advanced Level, Professional Development or Continuing Education

High School Diploma or Equivalent

Trust-Food courses #1 and #7

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees and food supply chain personnel

Assessment - Certification of Attendance – Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Lesson 1: Crypto wallets

This lesson dives into the exciting world of Crypto wallets.

Briefly introduce yourself and highlight the importance of secure crypto storage. Clearly state learning objectives, emphasizing key wallet differences. Use real-world analogies and visuals (infographics, icons) to explain wallet functions and formats. Conduct brainstorming sessions for wallet selection criteria and showcase hot/cold wallet usage (screencast/demo).

Emphasize strong passwords, MFA, and seed phrase security.

Briefly explain MFA with the provided definition.

Summarize key points with bulleted takeaways and encourage questions.

Offer additional resources and consider real-world case studies to reinforce security best practices.

Lesson 2: Fundamentals of blockchain technology

This lesson delves into the fundamentals of blockchain technology.

Clearly define blockchain test nets and their crucial role in development. Highlight different types (public, private, permissioned) with visual aids.

Showcase examples of test net usage (Ethereum 2.0 upgrade) and its benefits (testing, debugging). Introduce specific test nets for popular blockchains (Polygon, Avalanche) with token acquisition methods (faucets, airdrops).

Discuss limitations of test nets (resource limitations) and the importance of responsible usage. Briefly summarize key takeaways (benefits, choosing the right test net, safety).

Include a formative assessment question to gauge understanding.

Lesson 3: Test Net Faucets

This lesson dives into the specifics of Test Net Faucets.

Emphasize the value of Test Net Faucets for developers (free experimentation, learning, community building). Introduce different blockchains (Ethereum, Polygon, Avalanche) and their corresponding faucets.

Show a step-by-step process of acquiring test tokens using MetaMask and a faucet (e.g., Sepolia Faucet).

Discuss limitations of faucets (request frequency, resource limitations) and responsible usage practices.

Highlight the importance of community engagement for additional tokens and insights. Briefly summarize key takeaways (benefits, responsible usage, community). Include a formative assessment question to gauge understanding.

Lesson 4: Smart Contracts.

This lesson delves into the world of Smart Contracts. Here are some suggestions to make it informative and engaging:

Capture Attention & Introduce Core Concepts:

Briefly introduce smart contracts (automated agreements on blockchains) and highlight their potential benefits (reduced costs, transparency).

Explain key features: self-executing, trustless, and transparent execution based on code.s.

Deep Dive into Applications & Development:

Showcase real-world use cases of smart contracts in agri-food supply chains (traceability, payments).

Introduce different programming languages used for smart contract development (Solidity, Vyper, Michelson) with brief explanations.

Address Challenges & Look to the Future:

Discuss challenges like development complexity, security vulnerabilities, and legal uncertainties.

Explore the future potential of smart contracts in the agri-food sector (e.g., decentralized marketplaces, improved food safety).

Include a formative assessment question to gauge understanding (e.g., why is EVM needed for smart contracts?).

Lesson 5: Multisignature Transactions.

This lesson delves into the Multisignature Transactions. Here are some suggestions to make it informative and engaging:

Introduce & Highlight Security Benefits:

Briefly explain traditional transactions (single key) and introduce multisig (multiple keys for approval).

Emphasize the security advantages of multisig transactions (reduced unauthorized access, fraud risk mitigation).

Deep Dive into Applications & Considerations:

Showcase real-world use cases of multisig wallets (shared family accounts, crypto businesses).

Explain the process of setting up a multisig wallet using a popular service like Electrum.

Discuss both benefits (enhanced security, shared control) and risks (complexity, delays, human error) of multisig.

Explore Future Potential & Assess Understanding:

Briefly explore potential applications of multisig in the agri-food sector (e.g., supply chain verification).

Include a formative assessment question to gauge understanding (e.g., what does decentralization mean in multisig?).

Lesson 6: Security Considerations.

This lesson delves into the Security Considerations. Here are some suggestions to make it informative and engaging:

Capture Attention & Highlight Security Importance:

Briefly introduce blockchain security challenges (despite its strengths, vulnerabilities exist).

Emphasize the importance of security for protecting digital assets and user trust.

Deep Dive into Threats & Solutions:

Explain common vulnerabilities (key management, smart contracts, phishing) with real-world examples (e.g., Wormhole attack).

Discuss best practices for developers (code reviews, monitoring) and users (strong key management, software updates).

Promote Continuous Learning & Assessment:

Highlight the importance of staying informed about evolving threats.

Include a formative assessment question (e.g., why update software?) to gauge understanding.

Relevant Readings

Advanced Blockchain Concepts and Architectures:

Books:

Tapscott, D. & Tapscott, A. (2016). Blockchain Revolution: Hyperledger Fabric, Ethereum, and the Future of Distributed Ledgers. [Book 1: Blockchain Revolution]

Antonopoulos, A. M. (2017). Mastering Blockchain: Programming, Decentralized Applications and Future Technologies. [Book 2: Mastering Blockchain]

Articles:

Understanding Blockchain Consensus Algorithms. (2023, July 11). Medium: https://medium.com/@genesishack/understanding-blockchain-consensus-algorithms-433f0e1dc8bd

The State of Scaling Ethereum. (2023, April 14). ConsenSys: https://consensys.io/blog/the-state-of-scaling-ethereum

II. Crypto Wallets:

Books:

Lewis, A. (2018). Blockchain Basics: A Layman's Guide to Understanding the Technology That Underpins Cryptocurrencies, Decentralized Applications, and the Future of Finance. [Book 3: Blockchain Basics]

Articles:

Wallets vs Exchanges: Understanding the Difference. (n.d.). BitPay: https://bitpay.com/blog/wallets-vs-exchanges/

Cryptocurrency Wallets Explained. (2023, October 26). Investopedia: https://www.investopedia.com/cryptocurrency-wallets-5272123

Hardware Wallet. (n.d.). CoinDesk: https://www.coindesk.com/tag/hardware-wallet/

III. Testnets and Testnet Faucets:

Online Resources:

Rinkeby Faucet. Rinkeby Faucet: https://rinkebyfaucet.io/ (Example Ethereum Rinkeby Testnet faucet)

Binance Smart Chain Testnet Faucet. (2022, March 25). Binance: https://www.binance.com/en/feed/post/159397

Articles:

What Is a Testnet? A Beginner's Guide to Testnets in Crypto. (2023, January 12). Bitdegree: https://www.bitdegree.org/crypto/learn/crypto-terms/what-is-testnet

Best Crypto Faucets in 2023: Top Free Crypto to Claim. (2023, February 14). Crypto News: https://cryptonews.com/cryptocurrency/best-crypto-faucets/

IV. Smart Contracts (Basic Understanding):

Books:

Antonopoulos, A. M. (2017). Mastering Blockchain: Programming, Decentralized Applications and Future Technologies (Chapter on Smart Contracts). [Book 2: Mastering Blockchain]

Online Courses:

Smart Contracts with Solidity: Create an Ethereum Contract. Coursera: https://www.coursera.org/projects/smart-contracts-with-solidity-create-an-ethereum-contract

Introduction to Blockchain Technologies. EdX: https://www.edx.org/

V. Multisignature Transactions (Gnosis Safe):

Resources:

Gnosis Safe. Gnosis Safe: https://safe.global/ (Gnosis Safe Documentation)

Articles:

Multi-Signature vs Single Signature Wallets: What's the Difference? (n.d.). CoinMarketCap: https://coinmarketcap.com/alexandria/glossary/multi-signature-multi-sig

How to Create a Multisig Wallet Using Gnosis Safe: A Tutorial. (2022, August 10). Nextrope: https://nextrope.com/how-to-create-a-multisig-wallet-using-gnosis-safe-tutorial/

Course Provider - Contact Details

Comments and inquiries may be addressed to Leonid Khatskevych and Roman Kravchenko, 482.solutions - hello@482.solutions

Course #9: Applications of Blockchain in the Agri-Food Industry

Content and Duration

The lessons provided with the course “Applications of Blockchain in the Agri-Food Industry” are as follows:

Lesson 1: Blockchain in Farming and Agriculture

Lesson 2: Blockchain in Food Supply Chain

Lesson 3: Blockchain in Seafood and Fisheries

Lesson 4: Blockchain in Food Safety and Quality Assurance

Lesson 5: Blockchain in Fair Trade and Organic Certification

Lesson 6: Blockchain and Sustainable Agriculture

Approx. 5 hours to complete (including study time).

Objective

The course “Applications of Blockchain in the Agri-Food Industry” is designed to provide an understanding of how blockchain technology can be applied across different segments of the agricultural and food sectors. The course focuses on exploring the diverse applications of blockchain in enhancing traceability, transparency, and efficiency in farming, agriculture, food supply chains, seafood and fisheries, and food safety and quality assurance. Additionally, it investigates blockchain’s role in verifying the authenticity of fair trade and organic certifications and its potential contribution to sustainable agriculture practices,

including carbon trading. By analysing the benefits and challenges of implementing blockchain technology in these areas, the course equips participants with the knowledge to critically assess its impact and the practicalities of its adoption in the agri-food industry.

Learning Outcomes

What your trainees will learn:

- Blockchain in Agriculture & Food Supply Chain: Understand the revolutionizing effect of blockchain technology in agriculture and food supply chain in particular, particularly in enhancing traceability.
- Smart Contracts in Agri-Food: Learn about the implementation and advantages of smart contracts in farming, focusing on financial transparency and fairness.
- Blockchain in Food Supply Chain: Comprehend how blockchain can improve transparency in the food supply chain and the efficiency gains achievable through its application in supply chain management.
- Blockchain for Food Safety: Conceptualize the implementation of blockchain for food safety, recognizing its role in regulatory compliance and standard enforcement.
- Crisis Management in Supply Chains: Assess blockchain's potential in crisis management in supply chains.
- Blockchain in Certifying Fair Trade and Organic Products: Understand blockchain's role in authenticating fair trade and organic certifications and maintaining the credibility and integrity of these labels.
- Blockchain in Sustainable Agriculture: Gain insights into the application of blockchain in sustainable agriculture and its potential in promoting environmental sustainability.

Course Level - Education Level Required - Prerequisites

Beginners Level

Bachelor’s Degree

Consider this course as an advanced level of Course #6: “Introduction to Blockchain in the Food Supply Chain”.

Target Audience

Food Industry Professionals, Supply Chain Managers and Logistics Experts, Food Safety Regulators and Policy Makers, Technology Professionals with an Interest in Agri-tech, Agricultural Entrepreneurs and Innovators, Food Industry Consultants and Advisors, Academics and Researchers in Food Technology and Blockchain, Students in Food Science, Supply Chain Management and Technology.

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through different applications of blockchain in the agri-food industry, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin with an introduction that contextualizes blockchain technology in the agri-food industry. This could include discussing current challenges in the industry and how blockchain can address them.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Visual Icebreakers: There are several visual "helpers" within the course that could help you stimulate the interest and discussions regarding different applications of blockchain in FSC. For example:

- You could initialize this course by presenting a the video available in Lesson 1, slide 8, presenting how blockchain works, setting up the scene.
- You could leverage the variety of diagrams that are present in Lesson 4 and 5 to help you visually present to the participants difficult concepts and categorise information into smaller pieces.
- You could use image in Lesson 6, slide 14 to present the UN SDGs and initiate a discussion about how those are affecting the FSC and how blockchain could help address the related challenges.

Lesson 1: Blockchain in Farming and Agriculture

Begin by introducing the role of blockchain in farming and agriculture. Highlight the lesson's objectives, focusing on blockchain's ability to enhance traceability and transparency, and the use of smart contracts for fair farmer compensation.

Explain how blockchain technology enhances traceability from farm to consumer and the role of smart contracts in ensuring fair compensation to farmers.

Cover the basic definition of blockchain, its key characteristics, and core components.

Discuss the global challenges in agriculture and how blockchain can address them.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Engage participants with a question about the key features of blockchain technology as highlighted in a video or presentation.

Lesson 2: Blockchain in Food Supply Chain

Start with an introduction that outlines the objectives of the lesson, focusing on how blockchain technology enhances traceability, transparency, and efficiency in food supply chains.

Explain how blockchain ensures a transparent journey of food products from their origin to the consumer and how it streamlines operations in the supply chain.

Provide an overview of the food supply chain, including key stakeholders like producers, distributors, retailers, and consumers.

Summarize the key points discussed in the lesson, emphasizing the operational benefits of blockchain in food supply chains.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Engage participants with a question to evaluate their understanding of how blockchain can improve supply chain processes.

Lesson 3: Blockchain in Seafood and Fisheries

Begin by discussing the critical role of blockchain technology in the seafood and fisheries industry, especially in combating illegal fishing and promoting sustainability.

Cover key concepts such as how blockchain combats illegal fishing and contributes to sustainable fishing practices.

Address the various challenges faced in the seafood industry, such as supply chain management issues, data accessibility, environmental regulations, and lack of transparency.

Present case studies like FishCoin and Bumble Bee to illustrate real-world applications of blockchain in the seafood industry.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 4: Blockchain in Food Safety and Quality Assurance

Begin the lesson by discussing how blockchain technology enhances food safety and quality assurance within the agri-food supply chain.

Cover the key concepts of blockchain's immutable ledger for traceability, smart contracts for automating quality assurance, and real-time data for compliance and safety verification.

Ensure participants understand the basic definitions and fundamentals of food safety, and how blockchain technology applies to them.

Discuss the challenges in food safety and how blockchain can address these, including enhancing transparency and traceability.

Conclude the lesson by summarizing blockchain's transformative influence on food safety, emphasizing traceability, audit reliability, and consumer trust.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 5: Blockchain in Fair Trade and Organic Certification

Begin by discussing how blockchain technology can authenticate fair trade and organic product claims, focusing on the technology's capacity to maintain the integrity of these certifications.

Address the complexity of supply chains in fair trade and organic certification, including challenges like limited control, opaque processes, and market inequalities.

Detail how blockchain streamlines certification processes, reduces costs, and ensures full supply chain visibility and data integrity.

Discuss how blockchain technology verifies certifications and enhances transparency, reducing fraud and mislabelling.

Conclude with a summary of the lesson, focusing on blockchain's ability to verify fair trade and organic certifications and maintain their credibility.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Provide a list of references for further exploration of the topic.

Lesson 6: Blockchain and Sustainable Agriculture

Start by explaining the role of blockchain in promoting sustainable agriculture, including its application in carbon trading.

Cover the key concepts of using blockchain to support and verify sustainable farming methods and practices and how it facilitates transparent and efficient carbon credit trading.

Discuss blockchain's role in various aspects of sustainable agriculture, such as traceability, transparency, financial inclusion for farmers, and crop insurance.

Address the challenges in implementing blockchain in agriculture and discuss possible solutions or strategies to overcome these challenges.

Engage participants with a question about how blockchain facilitates sustainable farming and carbon trading.

Summarize the key points covered in the lesson, focusing on blockchain's potential to drive sustainable practices in agriculture.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Relevant Readings

- Motta, Giorgio Alessandro, Bedir Tekinerdogan, and Ioannis N. Athanasiadis. "Blockchain applications in the agri-food domain: the first wave." Frontiers in Blockchain 3 (2020): 6.
- Menon, Sheetal, and Karuna Jain. "Blockchain technology for transparency in agri-food supply chain: Use cases, limitations, and future directions." IEEE Transactions on Engineering Management (2021).
- Pakseresht, Ashkan, et al. "The intersection of blockchain technology and circular economy in the agri-food sector." Sustainable Production and Consumption 35 (2023): 260-274.

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

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Course #10: Smart Contracts with Example Applications in Food Supply Chain

Content and Duration

The lessons provided with the course "Smart Contracts with Example Applications in Food Supply Chain" are as follows:

Lesson 1: Introduction to Blockchain and Smart Contracts

Lesson 2: Types of Smart Contracts

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

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

Lesson 5: Benefits & Potential challenges of smart contracts

Lesson 6: Intro to Smart Contract Development

Lesson 7: The structure of a Solidity file

Lesson 8: Designing and Writing Smart Contracts

Lesson 9: Deploying and Testing Smart Contracts

Approx. 7 hours and 40 minutes to complete.

Objective

The objective of this course is to provide interested participants, with a particular focus on SMEs owners, managers, and employees in the FSC, the knowledge and practical skills necessary to understand, implement, and leverage blockchain technology as regards its relevance and application to smart contracts. The course consists of 9 lessons that will gradually equip the participants with the adequate knowledge and critical thinking skills necessary to understand, evaluate, and potentially contribute to the implementation of smart contracts in the Food Supply Chain.

Smart contracts that employ blockchain technology provide efficiency, transparency, and reliable transactions. Various types of contracts are investigated aimed at addressing problems encountered in the sector. By presenting the challenges currently faced in the FSC, participants can appreciate the potential benefits that smart contracts provide. Finally, by examining real-world applications trainees can grasp the practical implications of this technology, enabling them to make informed decisions and contribute effectively to the advancement of the food supply chain industry.

Fostering an innovative and collaborative mindset will be essential as participants move through the course in order to grab emerging opportunities and overcome any barriers to the adoption of blockchain technology. Furthermore, it emphasizes how crucial it is to keep learning and adapting as the area of blockchain technology quickly expands to keep participants at the forefront of business advancements.

Learning Outcomes

What your trainees will learn:

- Define the fundamentals concepts of blockchain and smart contracts.
- Identify key features of blockchain technology and understand their significance in transforming common procedures within the supply chain.
- Gain familiarity with popular smart contracts platforms and their unique features.
- Assess the advantages and risks of using smart contracts in the food supply chain.
- Learn how smart contracts create opportunities for future innovation.
- Evaluate the influence of smart contracts on matters such as the assurance of food safety, the deterrence of fraud, and the enhancement of supply chain efficiency and specify possible implementation scenarios for the following strategy or concept: specific instances wherein smart contracts contribute to the improvement of the food supply chain.
- Exhibit the utilization of smart contracts across diverse sectors of the food industry.

- Acknowledge the significance of traceability in ensuring the authenticity and excellence of products and evaluate the influence of smart contracts on matters such as food safety and food supply chain efficiency.
- Discuss intellectual property considerations and liability challenges associated with smart contracts.
- Evaluate the legal challenges and regulatory considerations associated with the use of smart contracts.
- Analyze potential barriers and solutions related to smart contract implementation.
- Learn the basics of Ethereum and Solidity and then explore Smart Contract Layout.
- Understand Decentralized Apps (DApps).
- Gain a comprehensive understanding of the entire smart contract development, testing, and deployment lifecycle.
- Get familiar with and dive into specific case studies of blockchain application in food quality assurance (covering different food categories).

Course Level, Education Level Required, and Prerequisites

Advanced Level, Professional Development or Continuing Education

Bachelor's Degree

Supply chain basics, Trust Food course #9 "Areas of application for Blockchain Technology", background in information technology and/or basic programming skills in order to understand the realm of smart contract development.

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees and food supply chain personnel with basic programming skills.

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Introduce yourself (few words about your background and expertise)

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to FSC and the applications of blockchain.

Create a concise map of expertise, skills, and experiences, that exist within your audience. This will help you to create groups for peer learning (e.g., mix IT with supply chain backgrounds) as well as to personalize the training experience.

The learning method adopted that deviates from the conventional method of just a trainer led training allows you for interaction and feedback while utilizing the material hosted on the online platform as a tool.

You can adapt the material to suit the individual needs of your participants and the human element present generates questions and collaboration among their peers.

By providing real-time, personalized instructions amplify the result of the learning process.

Immediate feedback and interaction with your audience will assist you in providing them a deeper understanding.

A set of methods for engagement are being explained below in order for you to be prepared. Additional to them, and to the preparation above, make sure to introduce the gamification elements through the quizzes that are included in all lessons.

Lesson 1: Introduction to Blockchain and Smart Contracts

Lesson 1 defines the fundamental concepts of blockchain and smart contracts. In every structured course the first lessons are dedicated in defining the concepts that are later going to be explained in detail. As the trainer, your primary aim is to ensure that participants comprehend in depth the fundamental concepts essential for navigating the subsequent lessons effectively.

You need to make sure that terms like decentralization, security and transparency that are widely used and referred to in the next lessons are thoroughly explained.

After defining the term consensus mechanism and introducing the two most used ones, Proof of Work and Proof of Stake, proceed by comparing them. The participants can have a better understanding of the two protocols this way. Encourage them to reflect on how these mechanisms contribute to the integrity of blockchain networks.

As the lesson progresses you are going to present the smart contracts' characteristics. This might be a good point to ask questions and trigger a discussion as a method for engagement. One example is "Are you aware of any smart contract use cases?" and then present the use cases in the next slide.

Continuing with the same method the next question could be "Do you know any smart contract platforms?". Use their responses as a starting point to introduce the platforms covered in Lesson 1, fostering a sense of collaboration and shared learning.

Lesson 2: Types of Smart Contracts

Lesson 2 investigates the different types of smart contracts that address specific problems that appear in the food sector, by streamlining processes.

As the trainer, your goal is to facilitate an engaging and participatory session that encourages active discussion and enhances participants' understanding of the subject matter. Engaging the participants in a discussion leads to better outcomes, and stronger relationships among participants. Begin by fostering a collaborative learning environment where participants feel comfortable to contribute. Encourage open dialogue by asking participants if they are familiar with any types of smart contracts. This approach promotes engagement and facilitates knowledge sharing among participants.

Present the different types of smart contracts relevant to the food sector, emphasizing their roles in streamlining processes and addressing specific challenges. Use examples to illustrate each type of contract, making the content more relatable and comprehensible for participants.

Considering the target group of participants, you should focus on the supply chain contracts. In order to stimulate the discussion at this point, make sure to use the image explaining the MQTT server as a visual icebreaker.

After discussing supply chain contracts, proceed to introduce and discuss the remaining types of smart contracts. Ensure that examples are provided for each type to reinforce understanding and facilitate further discussion.

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

Lesson 3 signifies the first step into the domain of smart contracts within the context of the food supply chain. As the trainer, before present the advantages and obstacles, it is crucial to provide participants with an in-depth understanding of the foundational technology, blockchain, and its applications in revolutionizing the food supply chain.

Considering the profile of the target group you could infuse humor into the session by stating: “I am certain you haven’t heard the term “Food Supply Chain” before, so let’s see what we mean with this term.” Most of the participants are familiar with the term therefore by joking you help create a positive atmosphere and foster engagement among participants.

It needs to reintroduce the concepts of blockchain technology and smart contracts, emphasizing their relevance to the food supply chain and how they enhance it. Backing up this argument you can then present the applications of smart contracts in the agricultural supply chain. This might be a good point to share a relevant story that illustrates key points for traceability or even better ask the participants to share a story that is relevant.

Finally, make sure to play the video towards the end of the lesson. Visualization of the content in a lesson that has been presented always has a better impact and could stimulate further discussion.

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

Lesson 4 delves into the practical applications of smart contracts within the food supply chain, highlighting how blockchain technology facilitates traceability, transparency, and security, thereby enhancing operational efficiency. Your role, as a trainer, is to illustrate specific use cases from various industries within the food sector to showcase the real-world impact of smart contracts.

You can analyze use cases from critical food industries, such as livestock, aquaculture, dairy, beverages, and frozen foods. By emphasizing the practical relevance of these technologies and showcasing how the abovementioned sectors employ them to optimize operations and address challenges within the sectors, you assist the participants in gaining insight and in realizing the real-world impact of smart contracts across various sectors.

Encourage participants to reflect on the presented use cases and consider how similar approaches could be implemented in their respective areas of work.

Lesson 5: Benefits & potential challenges of smart contracts

Smart contracts offer numerous benefits but also present potential challenges. Lesson 5 recaps the ways in which smart contracts are a useful and innovative technology that may be used in a variety of fields, including supply chain management, financial services, and contracts for other purposes. Key benefits of the smart contracts have already been mentioned, so you could request from the participants to list a few, engaging them this way to an active participation.

After summarizing all the key benefits of using smart contacts by utilizing the image in slide #9 you can proceed with the regulatory background that needs to be considered associated with the use of smart contracts. Make sure to explain in detail all the complex terms and topics such as jurisdictional matters, regulatory compliance and data privacy, keeping in mind that the participants might not be familiar with these terms. Provide clear examples and illustrations to enhance understanding.

Like every other innovative method that offers benefits with its application, several challenges and obstacles are met on the way. As the lesson comes to its end you then need to present the barriers of smart contract governance, international trade implications, and the evolving landscape of insurance policies. While these disadvantages exist and participants as interested parties need to be aware of them, highlight the fact that they do not make smart contracts unsuitable for various applications. On the contrary, after careful planning, auditing, and considering the specific use cases when implementing smart contracts, they are prepared to overcome any obstacle that is met and achieve optimum results by the application of blockchain technology via smart contracts.

Lesson 6: Intro to Smart Contract Development

Lesson 6 presents a practical application of smart contracts, focusing on Ethereum as a prominent platform for their implementation.

Considering the lesson's content, you need to delve into the decentralized ecosystem of Ethereum while keeping in mind that your participants cope with the advanced level and follow through the progress.

Examine if your participants are familiar with smart contacts development so as to be aware of the way you are going to address the lecture, based on their experience level to ensure effective communication and understanding. If participants are new to smart contract development, provide thorough explanations and examples. If they have prior knowledge, delve deeper into advanced topics and techniques.

Present Solidity as an example of a high-level programming language that plays a pivotal role in smart contract development on the Ethereum platform along with its characteristics. Regardless of your participants' experience level assisting them in gaining a grasp of Solidity will be essential to utilizing blockchain technology and realizing the possibilities of decentralized apps in general.

Upon completion of this section, advise them to follow the link https://docs.soliditylang.org/en/v0.8.24/ dedicated to Solidity. Writing and implementing smart contracts on Ethereum-based blockchains is part of the Solidity development process. The platform and tools required for programmers to create these smart contracts and decentralized apps (DApps) are provided by Solidity.

The lesson ends with details of the actual structure of a contract where you can provide the participants with insights into the components and functionalities. At this point you can follow the visual icebreaker method by utilizing the video in slide #30. This example

showcases a complete application of a smart contract development on Ethereum and by jumping into a visual aid will elaborate on the lesson's progress and amplify its effect on the audience.

Lesson 7: The structure of a Solidity file

In lesson 6 you presented Solidity, the driving force behind decentralized application development that provides expertise at well-structured and effective smart contracts creation. Lesson 7 requires that you delve deeper into the core elements of Solidity file structure and reassure that your participants comprehend it.

Aiming at empowering the participants as potential developers, able to create secure, efficient and maintainable decentralized applications, you should adopt the holistic approach that the context follows, emphasizing the significance of optimization techniques, licencing compliance, best practices and clear documentation through comments. Provide examples and practical insights to reinforce understanding.

Highlight the importance of commenting in code and its role in enhancing readability, maintainability, and collaboration among developers.

Encourage interactive learning by inviting participants to ask questions and share their experiences with commenting in code. Facilitate discussions on common challenges and solutions related to commenting practices in Solidity development.

Lesson 8: Designing and Writing Smart Contracts

Lesson 8 serves as a reminder of key concepts essential to smart contract development, including decentralization, transparency, traceability, and immutable ledgers. At the very beginning of this lesson, you can encourage your participants to define these terms. Active participation hinges on recognizing the diverse learning preferences of the participants.

Provide an overview of the fundamentals of smart contract development, highlighting its principles and key concepts. Emphasize the importance of following these principles, especially in complex systems like the food supply chain, to ensure the effectiveness and reliability of smart contracts.

Transition to practical skills necessary for navigating the dynamic field of smart contract development. Cover topics such as writing code, implementing best practices, and addressing challenges encountered during development. Provide examples and hands-on exercises to reinforce learning and enhance understanding.

Complete the lesson's presentation with the methods that prioritize accessibility, simplicity and user experience in smart contract development. Emphasize the importance of developing user-friendly smart contracts that are easy to understand and to use for all stakeholders involved.

Throughout the lesson, encourage participants to reflect on their own experiences and share insights with the group. Facilitate discussions on practical applications and real-world scenarios to deepen understanding and foster collaboration among participants.

Lesson 9: Deploying and Testing Smart Contracts

Course #10 is concluded with lesson #9. In order for your participants to implement smart contracts confidently and in accordance with best practices, lesson #9 gives you the opportunity to provide them with a thorough explanation of the complexities involved in developing Ethereum smart contracts.

The importance of extensive unit testing and its role in early detection issues across the development life cycle by delving into well-known frameworks like Truffle and Hardhat is one of the topics that need to be highlighted.

Cover the setup and configuration of testing environments using Hardhat and Truffle. Walk participants through the process step-by-step, ensuring they gain practical experience in configuring testing environments for smart contract development.

Introduce participants to sophisticated deployment strategies and the value of security audits in building reliable decentralized apps. Discuss the importance of integrating testing and security measures into the deployment process to ensure the integrity and security of smart contracts.

Finally, make sure to use the following videos as visual material, to showcase practical examples and demonstrations of deploying smart contracts, to strengthen lesson content and enhance understanding:

https://www.youtube.com/watch?v=bZKVfXmzRDw

https://www.youtube.com/watch?v=ooN6kZ9vqNQ

By following these guidelines, you will create a supportive learning environment where participants feel valued and engaged, setting the stage for meaningful exploration of smart contracts in the food supply chain.

Relevant Readings

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Course Provider / Contact Details

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Course #11: Blockchain platforms

Content and Duration

The lessons provided with the course “Blockchain platforms” are as follows:

Lesson 1: Introduction to Blockchain Platforms

Lesson 2: Exploration of Key Blockchain Platforms – Part I

Lesson 3: Exploration of Key Blockchain Platforms – Part II

Lesson 4: Exploration of Key Blockchain Platforms – Part III

Lesson 5: Exploration of Key Blockchain Platforms – Part IV

Lesson 6: Exploration of Key Blockchain Platforms – Part V

Lesson 7: Exploration of Key Blockchain Platforms – Part VI

Lesson 8: Exploration of Key Blockchain Platforms – Part VII

Lesson 9: Exploration of Key Blockchain Platforms – Part VII

Comparison of Blockchain Platforms

Approx. 9 hours to complete (including study time).

Objective

The course “Blockchain Platforms” aims to provide an understanding on different blockchain platforms and their specific applications, particularly in the context of the food supply chain. Participants will gain insights into various types of blockchain platforms, each with its unique strengths, limitations, and use-cases. The course begins with an introduction to the fundamental types and purposes of these platforms. This course covers major platforms like Ethereum, Hyperledger Fabric, IBM Food Trust, VeChain, Tezos, NEAR, Polkadot, and Solana. Each lesson will focus on the unique aspects of these platforms, including smart contracts, decentralized applications, private and permissioned blockchains, scalability, and developer-friendly interfaces. Participants will examine real-world case studies to understand how these platforms are applied in the food supply chain, evaluating factors such as security, scalability, consensus mechanisms, and smart contract functionality. This course is designed to equip learners with the knowledge to critically assess and choose the most appropriate blockchain platform for various applications in the food supply chain.

Learning Outcomes

What your trainees will learn:

- Overview of Blockchain Types: Understand the differences between public, private, and consortium blockchains, and their specific applications in the food supply chain.
- Blockchain's Role in Food Supply Chain Management: Comprehend how blockchain platforms enhance traceability, transparency, and efficiency from farm to table.
- Ethereum's Applications: Gain knowledge of Ethereum's smart contracts and decentralized applications, and their contributions to food safety and supply chain transparency.
- Hyperledger Fabric's Business Applications: Understand the architecture and unique features of Hyperledger Fabric, recognizing its advantages and potential in improving supply chain efficiency and security in the food industry.
- IBM Food Trust Platform Analysis: Analyse the IBM Food Trust platform's role in enhancing food safety and its impact on supply chain processes.
- VeChain in Supply Chain Management: Grasp VeChain's role in supply chain management, citing real-world examples of its application in the food industry.
- Tezos' Application in Agriculture: Understand Tezos' application in decentralized solutions for agricultural insurance and its role in enhancing food safety and quality in the supply chain.
- NEAR Protocol's Unique Features: Recognize the unique features of NEAR Protocol and assess its potential in driving innovation and enhancing supply chain solutions in the food industry.
- Interoperability in Polkadot: Understand the concept of interoperability in Polkadot, its function, benefits of sidechains, and its importance for the food supply chain.
- Solana's Technological Advantages: Evaluate Solana's technological features and its suitability for large-scale, real-time operations in the food industry.
- Comparative Analysis of Blockchain Platforms: Analyze and compare various blockchain platforms, identifying the best-suited technologies for specific applications in the food supply chain.

Course Level – Education Level Required – Prerequisites

Intermediate Level, Professional Development

Bachelor's Degree

Consider this course as an advanced level of “Course 1: Introduction to Blockchain Technology and Digital Assets”, “Course 7: Basic Blockchain Skills”, “Course 8: Advanced Blockchain Skills”.

Target Audience

Professionals in the Agri-Food Industry, Blockchain Developers and Technologists, Supply Chain Managers, Academics and Researchers, Students in Related Fields

Assessment – Certification of Attendance – Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through different blockchain platforms, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Engaging Introduction to Blockchain Platforms: Start with an interactive discussion about the various blockchain platforms and their impact on different industries, especially the agri-food sector. This can set a relevant context for the course.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Simplify Complex Concepts: Blockchain technology can be complex. Use simple analogies or real-life examples to explain the fundamentals of different blockchain platforms.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Visual Icebreakers: There are several visual "helpers" within the course that could help you stimulate the interest and discussions regarding different blockchain platforms. For example you could use (among others):

- The video available in Lesson 2, slide 10, which explains Ethereum.
- The video in Lesson 2, slide 6, which explains Hyperledger Fabric.
- The video in Lesson 3, slide 16, which explains VeChain.
- The video in Lesson 4, slide 11, which explains Tezos and in particular baking.
- The video in Lesson 5, slide15, which explains NEAR.
- The video in Lesson 6, slide 5, which explains Polkadot.
- The video in Lesson 7, slide 6, which explains Solana.

Lesson 1: Introduction to Blockchain Platforms

Start the lesson by introducing the various types of blockchain platforms and their significance in the food supply chain. Emphasize the course's goal of familiarizing participants with these platforms and understanding their applications.

Discuss the key concepts related to different blockchain types, including public, private, and consortium blockchains, and their roles in food supply chain management.

Offer an in-depth explanation of each blockchain type, discussing their unique features, advantages, disadvantages, and examples. Assess participants' understanding of the primary types of blockchain platforms and their potential uses in the food supply chain.

Conclude the lesson by summarizing the different blockchain types and their applications in enhancing traceability and efficiency from producer to consumer.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 2: Exploration of Key Blockchain Platforms – Part I

Start the lesson by highlighting Ethereum's significance in the landscape of blockchain platforms, especially its application in smart contracts and decentralized applications (dApps) within the food supply chain.

Dive into Ethereum's smart contracts, explaining their role in food traceability and safety, and discuss the impact of dApps in enhancing supply chain transparency.

Provide insights into the architecture of Ethereum, including its virtual machine (EVM) and the functionality of its native currency, Ether.

Present a case study, such as TE-FOOD, to demonstrate Ethereum's practical application in the food supply chain.

Summarize the key points of the lesson, focusing on Ethereum's smart contract functionality and its application in the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Engage participants with a question about the differences between Ethereum and Bitcoin to assess their understanding of blockchain platforms.

Lesson 3: Exploration of Key Blockchain Platforms – Part II

Begin by introducing Hyperledger Fabric as a private, permissioned blockchain platform ideal for business applications, focusing on its use in the food supply chain. Discuss the key

features of Hyperledger Fabric, such as its modular design, privacy and confidentiality, scalability, and performance.

Explore how Hyperledger Fabric's architecture lends itself to secure, efficient supply chain management. Present a case study on IBM Food Trust as a specific application of Hyperledger Fabric in the food supply chain.

Summarize the lesson, focusing on Hyperledger Fabric's modular and configurable design and its role in enhancing supply chain efficiency and security.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Engage participants with a question about Hyperledger Fabric's suitability for business applications in industries like supply chain management.

Lesson 4: Exploration of Key Blockchain Platforms – Part III

Start by introducing the IBM Food Trust platform, focusing on its design for the food supply chain, and how it ensures food safety and supply chain efficiency.

Explain how the IBM Food Trust ensures food safety and traceability and streamlines supply chain processes.

Discuss the challenges in the food supply chain, such as limited transparency, and how IBM Food Trust addresses these issues.

Provide an in-depth overview of the IBM Food Trust platform, including its use of blockchain technology, key features, and benefits.

Summarize the key points covered in the lesson, focusing on the tailored design of IBM Food Trust for food safety and supply chain efficiency.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 5: Exploration of Key Blockchain Platforms – Part IIII

Start by introducing VeChain, focusing on its specialization in supply chain and logistics, particularly in the food industry. Explain VeChain's unique features that address logistics challenges, such as its dual-token economy, turnkey software solutions, and fee delegation protocol.

Cover the technical aspects of VeChain, including its consensus model (Proof of Authority), governance, efficiency, and smart contract functionality.

Present real-world examples of VeChain's application in the food supply chain, illustrating its practical implementation and effectiveness.

Summarize the key points covered in the lesson, focusing on VeChain's specialization in supply chain logistics and its real-world application in the food industry.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lesson 6: Exploration of Key Blockchain Platforms – Part IV

Start the lesson by introducing Tezos, focusing on its role in agricultural insurance and the food supply chain. Highlight Tezos' unique features contributing to food safety and quality assurance.

Discuss Tezos' key features like self-amendment, formal verification, and its liquid proof-of-stake mechanism. Explain how these features make Tezos suitable for agricultural and food supply chain applications.

Highlight Tezos' application in enhancing traceability, using immutable records for product tracking, and implementing smart contracts for process automation in the food supply chain.

Conclude with a summary of Tezos' potential to revolutionize safety and quality assurance in agriculture, emphasizing its innovative features and applications.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Engage participants with a question about Tezos' enhancement of agricultural insurance and food supply chain management.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 7: Exploration of Key Blockchain Platforms – Part V

Begin the lesson by introducing the NEAR Protocol, focusing on its scalable and developer-friendly features. Highlight how NEAR can be effectively applied in the food supply chain.

Discuss NEAR's scalable design, sharding mechanism, proof-of-stake consensus model, and cross-chain interoperability. Emphasize how these features contribute to its efficiency and suitability for food supply chain applications.

Explore the practical application of NEAR in the food industry, such as in sustainable urban agriculture initiatives like Raiz Vertical Farms.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Engage participants with a question about NEAR Protocol's scalable design and developer-friendly features and their contribution to its suitability for use in the food supply chain.

Provide a list of references for further exploration of the topic.

Lesson 8: Exploration of Key Blockchain Platforms – Part VI

Start by introducing Polkadot, focusing on its unique interoperability and the utilization of sidechains. Emphasize how these features can enhance solutions within the food supply chain.

Explain Polkadot's interoperability and the role of sidechains in creating tailored solutions for the food supply chain.

Discuss the core features of Polkadot, such as scalability, consensus mechanism, security model, upgradeability, and cross-chain composability.

Describe Polkadot's architecture, including the relay chain, parachains, and bridges.

Explain Polkadot's impact on the broader blockchain space and its capabilities in cross-blockchain transfers.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Provide a list of references for further exploration of the topic.

Lesson 9: Exploration of Key Blockchain Platforms – Part VII

Begin by explaining Solana's high-speed and high-capacity features and how they can revolutionize operations in the food industry.

Present Solana's unique technical features, such as its transaction speed, low latency, and innovative architecture.

Discuss Solana's growing ecosystem and its diverse applications, including DeFi and NFTs.

Explore how Solana's features can be applied to large-scale agricultural operations, focusing on scalability, cost-effectiveness, and integration with IoT for precision agriculture.

Conclude by summarizing Solana's impact on supply chain management, particularly its high performance and potential in large-scale operations.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Provide a list of references for further exploration of the topic.

Lesson 10: Comparison of Blockchain Platforms

Start by introducing the lesson's focus on comparing various blockchain platforms, emphasizing their unique features and relevance to the food supply chain.

Outline the criteria for comparing blockchain platforms, such as security features, scalability, and smart contract support.

Provide a detailed overview of each blockchain platform, covering their distinct characteristics and their impact on food supply chain applications.

Lead a comparative analysis of the platforms based on the predefined criteria, encouraging participants to evaluate each platform's strengths and limitations.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Provide a list of references for further exploration of the topic.

Relevant Readings

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- Antonopoulos, A. M. and Wood, G. (2018) Mastering Ethereum: building smart contracts and dapps. O'Reilly Media.
- Hyperledger. Hyperledger Fabric. Available at: https://www.hyperledger.org/projects/fabric
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- ConsenSys. Quorum. Available at: https://consensys.net/quorum/
- Litecoin. Available at: https://litecoin.org
- Solana, Web3 Infrastructure for Everyone. Available at: https://solana.com/
- VeChain, Available at: https://www.vechain.org/

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

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Course #12: Blockchain and Traceability in Relation to Food Supply Chain Integrity

Content and Duration

The lessons provided with the course "Blockchain and Traceability in Relation to Food Supply Chain Integrity" are as follows:

Lesson 1: A holistic approach to food supply chain integrity

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

Lesson 3: Examples of traceability systems in different food sectors

Lesson 4: Blockchain principles

Lesson 5: Using blockchain principles in designing traceability systems

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

5 to 6.5 hours

Objective

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. 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.

Learning Outcomes

What your trainees will learn:

- Recognise the holistic approach to food integrity
- Explain the steps in designing a food traceability system and describe its benefits and challenges
- Describe how RFID and QR codes could be used in traceability systems in the food sector
- Recognise the operating principles of blockchain and explain its functionalities

- Identify how blockchain functionalities can support food supply chain traceability
- Recognise benefits and challenges in the implementation of blockchain-based traceability systems in the food sector through concrete examples

Course Level, Education Level Required, and Prerequisites

Intermediate level, Professional Development or Continuing Education

To follow this course, minimally a bachelor's degree or equivalent is required

To follow this course, experience in the food sector in quality control and/or assurance, food quality logistics, and/or quality management is expected. It is advised to first follow TRUST-FOOD courses "*6 – Introduction to Blockchain in the Food Supply Chain*" and "*7 - Basic Blockchain Skills*".

Target Audience

Food professionals working in small and medium enterprises in the food sector, such as employees working in procurement, supply control, quality control, and assurance (QC and QA) and senior managers (QC and QA). The module is also useful for just graduated students (University, Applied Science) who start searching for a job.

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

We follow a combination of two learning theories, namely behaviorism for gaining basic knowledge, and constructivism for problem-solving and critical analysis.

Introduce yourself (a few words about your background and expertise).

Participants introduce themselves and share their expertise, skills, and experiences relevant to food traceability and blockchain.

The trainer could check the latest food fraud/integrity issues to attract the interest of participants. You could ask participants about the implications of these issues for consumers, businesses and authorities. The findings can be mapped/categorised and a picture can be made to use in following lectures where relevant.

Message to the trainer - In this module, the note sections below the power point slides provide detailed information. You could use these notes during lecturing. In lesson 1, you can find the overall aim of the module (in slide #2) and the main learning outcomes for each lesson (in slide #4).

Lesson 1: A holistic approach to food supply chain integrity

Emphasize that a holistic approach to food supply chain integrity is necessary not only to ensure safe, palatable, and authentic food but also to assure that consumers can trust and trace the origin of their food. Just having a food safety management system in place is not enough as it does not prevent deliberate contamination. However, traceability and new technologies, such as blockchain, could support food safety, high quality, and authenticity by enhancing trust and transparency.

Then, introduce lesson 1, mention the topics addressed, and the objective of this lesson (slide #6).

Before slide #7, you could ask the participants what they consider the differences between food integrity and food fraud and map their different opinions/descriptions. Then introduce the food integrity and food fraud key concepts and reflect on what has been mentioned by the participants. Followingly in the learning outcomes slide #8, stress what they should be able to do after this lesson.

Before showing slide #9, you could ask the participants what could be the reasons for the decline in customer and consumer trust in food supply chains. If they mention any reason, then you could connect them with your explanation and further elaborate it with other reasons given in the slide (e.g. more complex food supply chain and stricter regulations).

Before showing slide #10, you could ask to participants what they consider as elements of food integrity. If they give any examples, then you can connect them to the elements as described by Manning and Monaghan et al (2019). Also, stress that there is no univocal concept for food integrity and various studies described food integrity elements differently.

In slides #11-12, extra examples are mentioned that you could further elaborate by connecting them to the defined food integrity elements in the previous slide.

In slides #13 and 14, figures could support you in explaining the holistic approach to food integrity and its connection with food fraud.

In slides #15-18 integrity issues and their implications are described. You could first ask the participants if they know any story on product, process, people and data integrity frauds. It can be asked per food integrity element. An alternative could be that the participants are grouped into product, process, people and data integrity issues and they search for three issues and share them plenary. In case of the latter activity, you could choose to skip slides #15-18 or only emphasize the extra examples given in these slides.

In slide #19, you could stress out the connection to the other lessons in this course. For example, product and process integrity can be supported by traditional traceability systems, which will be discussed in lessons 2 and 3. Whereas data and people integrity needs extra technological solutions, which we will delve deeper into in lessons 4, 5 and 6.

In slide #20, you could use the given questions for a formative assessment of participants.

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

You could start the lesson by asking participants if they have any feelings of distrust in food and/or feel the need to know the origin and history of food products they purchase.

Explain that because of reoccurring food safety and authenticity issues, a growing number of consumers and regulators in food supply chains require fast and reliable systems that support retrieving information on their food products. Traditional traceability systems, introduced after the adoption of the requirement in the General EU Food Law (2002), play an important role in tracking and tracing food products. However, the effectiveness of these systems can be compromised by, amongst others, information loss and data tampering. Before introducing blockchain technology as a way to overcome these challenges, this lesson introduces the principles of traditional food traceability systems.

Then, start with slide#2 describing the lesson introduction, topics and objective.

Before slide #3, you could ask participants what the difference is between tracking and tracing. Using the figure you can introduce the key concepts of this lecture i.e., tracking, tracing and track and trace (T&T) system or in other words traceability system. Followingly, you can connect these explanations with what food traceability is by using the given definitions by the FDA and EU Regulation (EC) No 178/2002.

In slide #4, the learning outcomes, you could stress what they should be able to do after this lesson.

To explain the concept of traceability in the food supply chain context, slide #5, shows the role of traceability in quality management, the legal requirements, and the consumer perspective. You could provide international and national legislation examples. You could explain that there are special traceability rules for some products (e.g., GMO, and animal products) and stress the European Union incentives for these strict food supply chain traceability rules.

In contrast to the HACCP principles, there are no strict requirements on what a traceability system should contain. The elements described in slide #6 are common elements. Likewise, there is no univocal way to design a traceability system. Slide #7 shows common steps in designing a food traceability system. If the participants are from SMEs or other food supply chain enterprises, you could ask them which design steps they applied in their traceability system and ask them to briefly explain. You could note the input from the participants and discuss the similarities and differences.

Slides #8 - #12 describe the common steps in designing a traceability system. Where relevant refer to the input given/shared experience of the participants as discussed above.

Slide #9 shows an overview table of traceability strategies and objectives and you could ask participants (if from SMEs/enterprises) about what the strategy of traceability system in their company would be, and otherwise discuss the possible/expected implications of the various strategies on the design of the T&T.

In slide #10, you could point to figures to show batch-level or product-level TRU examples.

In slide # 12, you explain the steps in data handling. You could ask the participants what kind of technologies they use or could be used at the different steps before you show slide 13#, where you can reflect on the given examples or elaborate some in more detail. You could mention that QR and RFID technologies will be examined in the next lesson.

Slides #14-16 list the benefits and challenges of applying traceability systems. You could ask the participants to identify benefits and challenges which you can list on a board. Then you can reflect on their input by showing how the benefits have been categorised based on a food safety, consumer and wholesale distributor perspective. Likewise, you can show the categories of challenges.

Another option could be, that you ask participants to put on post-its 2-5 benefits and 2-3 challenges. Then they have to assign their input to the various categories that are shown on flip-overs. After the exercise, you can briefly scroll through the slides to reflect on their input.

In slide #17, you could use the given questions for a formative assessment of participants. Before moving on to the next lesson, you could read the corresponding articles used in the cases in lesson 3 and recommend the participants have a look at those articles.

Lesson 3: Examples of traceability systems in different food sectors

Introduce the lesson by using the given introduction text, the lesson description and the objective of this lesson (slide #2).

Before showing slide #3, you can ask the participants if they can recall the steps in designing a food traceability system and then you stress the learning outcomes (slide #4).

Before showing slide #5, you can check how familiar the participants are with RFID technology and if they have seen an RFID Tag on any food package. Then you could use the given RFID figure to explain its basic operating principles (slide #5).

Explain Case Study 1 to the participants by introducing the drivers (market and compliance-oriented) of traceability strategy selection and mention the conducted activities while designing the traceability system for the current case study (slide # 6).

In the traceability system design, one of the first needs is identifying the key actors in the supply chain and describing the production steps of the Parmigiano cheese (slide #7). Thereafter, one needs to define what kind of information is needed for the traceability system design process (slide #8). Here, or at slide #9, you can explicitly mention the traceable resource unit (= the whole cheese) for this case study.

In slides # 9-10, explain how the data is decided to be traced for Parmigiano Reggiano cheese. In slide #11, summarize the data flow that you explained in the previous slides. You could ask the participants about the advantages and possible disadvantages of using RFID tag records for the cheese company.

Before starting the next case study, you could ask the participants to answer formative question (slide #12).

In slide #13, you could use the given QR figure to explain its basic operating principles. Then you could ask participants if they have seen any QR code on any food package and tried to scan it. You could also provide the participants with an exercise, in which they need to scan the QR code of examples that you have brought to the class. You can ask the participants to explain what they notice.

Similar to the previous case study, introduce case 2 and mention the drivers for the traceability strategy decision and the identified key actors and the production steps in the pork meat supply chain (slides #14-17). Define the needed information for the traceability system design process and highlight that the carcass at the slaughtering enterprise is the traceable resource unit, where a 2D traceable label is applied to the carcass (slides #18-20). In slide #20, mention that the figure demonstrates the traceability data flow for the defined pork meat supply chain with a QR code.

Slide #21 demonstrates how the data will be handled by using the QR codes. Explain who should upload the data and how the data can be traced by different actors.

In slide #22, you could ask the participants to answer the formative question.

Lesson 4: Blockchain principles

Before starting the lesson, you could first ask the participants what they know about blockchain. For the SME participants, you can ask if they have any experience with blockchain technology.

Then you can start lesson 4, by introducing the lesson using the given introduction text, the lesson description, and mentioning the objective of this lesson (slide #2).

To understand the basic principles of blockchain it is important to recognise the various terms used. These are briefly described in slide #3, including the genesis block, node, miners, smart contract, consensus, hash, transaction and cryptography key concepts. When the terms are used in the following slides, you could explain them again to enable the participants to understand the blockchain principles.

In the learning outcomes slide #4, you could stress what they should be able to do after this lesson.

In slide #5, you briefly introduce the blockchain logic. Followingly, in slide #6 you explain what a block in the chain contains and how each block is linked to another one using the given figure.

Next, you will introduce the security principles of blockchain technology (slide #7), which are further described in slides #8-9. In slide #10, you explain how the basic security principles are accomplished through cryptography and consensus algorithms in the blockchain system.

Before slide #11, you could ask the participants if they know which functionalities a blockchain possesses. Then, you use the figure (slide#11) to give an overview of the main blockchain functionalities, which you explain in detail using slides #12-13.

Stress that a distinctive feature of blockchain technology is its decentralized control of transactions by predefined consensus algorithms. In the verification of a transaction, control is not based on a single actor but on consensus rules. This enables a trustful verification of new transactions by multiple actors. Slide #14 shows some examples of consensus algorithms.

The Figure in slide #15, shows how the blockchain can be expanded with additional blocks and capture the entire history of transactions. The Figure illustrates that through this process a continuous encrypted record of the transaction is kept and becomes immutable once added to the blockchain.

Then, stress that the operation principle and security of a blockchain network depend on the architecture. The blockchain architecture can differ based on the resolution (consensus) algorithms and the level of openness; some algorithms emphasize decentralization and anonymity, while others prioritize throughput and speed. The Figure in slide #16 shows examples of blockchain architectures. You could ask participants if they are familiar with any private or public blockchain technology.

Before showing slide #17, you could ask participants if they have heard about cryptocurrency and if they know whether Bitcoin has a public or private architecture, and then you could introduce Bitcoin and Ethereum as blockchain network examples that use the public architecture.

In slide #18, you could introduce the Hyperledger Fabric as an example of a blockchain network that uses private architecture.

In slide #19 you could ask the participants to answer the formative questions.

Lesson 5: Using blockchain principles in designing traceability systems

You could start the lesson by asking the participants how blockchain principles could support traceability systems and list the replies. You can refer to the input during the lesson.

Then introduce lesson 5, show the topics that will be addressed and mention the objective of this lesson (slide #2).

Before starting to explain the key concepts, you can state that smart contract is one of the key concepts of this lesson, as in the previous lesson, and that you will not use the same explanation as the previous lesson to show the participants different definitions.

In the learning outcomes (slide #4), you could stress what they should be able to do after this lesson

In slide #5, you could highlight that understanding the current challenges and needs in food traceability can be useful to be able to comprehend the reasoning behind the usefulness of a blockchain-implemented traceability system.

In slides #6-7 you explain the ‘transparency’,‘open-source access’, 'decentralised' and 'autonomous' functionalities of blockchain in the context of the food supply chain traceability.

In order to stress the importance of the decentralised functionality of blockchain, you could use the table in slide #8 where it is compared with the centralised traceability system.

You can continue to explain 'immutability' and 'anonymity' functionalities of blockchain in the context of the food supply chain traceability in slide #9.

Before showing slide #10, you could ask to the participants whether they remember the general aspects of designing a food traceability system explained in lesson 2. Then, you could mention that these general aspects should still be considered here. Then you could introduce the specific aspects to consider while designing a blockchain-based food traceability system. You could also stress that all these steps are recommended to consider, however, they might be modified based on the design requirements. For instance, there might be additional steps or some of the steps might be merged.

Stress that categorisation of requirements can be useful while identifying them in this step (slide #11) Then, you could mention that also deciding the source of information might be important while eliciting the traceability system requirements (slide #12).

Stress that layered architecture can be used as a designing tool which can provide a structured approach to the designing process and you could use the figure in slide #13 to show some example layers. You can mention that these layers can be involved or excluded from the architecture based on the design`s aim. Then you can explain the introduced layers through slides #14-15.

Stress once more that a layered architecture can be built based on the requirements/aims of the design and you could support this by showing the given example in slide #16

In the next step, the design can be evaluated to assess the applicability of the designed blockchain technology so far based on collected requirement information in the previous design steps. You can use the given flowchart in slide #17 to show some simple example evaluation questions.

Explain briefly some of the empirical performance evaluation methods given in slide #18. If the participants are interested in knowing more about the evaluation methods you could direct them to the mentioned publication for further details.

In slide #19 you could ask the participants to answer the formative questions.

Before moving on to the next lesson, you could read the corresponding articles used in the cases in lesson 6 and you could also recommend the participants to have a look at those articles.

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

Introduce the lesson by using the given introduction text and the lesson description and the objective of this lesson (slide #2).

Before showing slide #3, you ask whether participants have heard about the Internet of Things and cloud computing, then you could explain them as key concepts. After that, you stress the learning outcomes (slide #4).

Before showing slide #5, you can ask the participants if they can recall the general traceability system design and blockchain-based traceability system design steps, then you can briefly go through them in order. You can highlight that, as mentioned in the previous lessons, these steps are recommended to consider while designing, but there might also be additional steps based on the design requirements.

Next, you will continue with the first case study. It is recommended as trainer to first read the article to get a thorough understanding of the case. In short; Yang et al. (2021) designed a traceability system based on blockchain technology for the storage and query of product information in the supply chain of fruits and vegetables. The designed system has been applied to an apple company in China.

In slide #7, you could remind the participants that first the key actors and production steps should be identified.

Before showing slide #8 you can remind the participants that the first step of designing a traceability system is defining the traceability strategy. You can ask participants if they can recall examples of traceability strategies. Then, you can discuss the traceability strategies that were chosen for this specific case study.

While explaining the traceable resource unit for this case study, you could mention that in the processing stage picked fruits and vegetables are classified, weighed, and boxed and a two-dimensional code (point to the given image) is attached to the box. Therefore this box of apples can be thought of as a traceable resource unit for this case study (slide #9).

At slide #11, you could mention that the blockchain-based traceability system design steps start here. You could also mention that the identified requirements, as described in the case study, have been classified into usage, technical and interoperability requirements, as was recommended in lesson 5.

In slide #12, you could mention that in this case study the architectural design step also involves data privacy considerations and design steps continue in line with this data privacy decision. This extra consideration might be a good example to stress that there might be minor modifications in the context of design steps based on the design requirements/aims.

At slide #13, remind participants that they have seen some example layers in lesson 5 and here these layers are specifically defined for this case study. You could stress that the layers in architecture can be selected/defined based on the design requirements/aims.

In slide #14, you could stress that the suitability of blockchain for the selected supply chain is checked and the most suitable blockchain technology is determined based on the collected information so far. In this case study, at the end of the tailoring step, Hyperledger Fabric was selected as blockchain technology, and they decided to use consortium/ federated network architecture, and practical Byzantine Fault Tolerance consensus algorithm to apply. Followingly, the designed system`s performance is evaluated by using the benchmarking method (slide #15), which is one of the introduced methods in lesson 05.

In slide #16, you could direct the participants to the QR code given in the slide to see more details on the designed application module.

The second case study aims to develop a traceability system for a private meat company to meet the real needs of a traceability system in the meat industry (i.e., control and enhance the product quality and make the product's origin transparent to the final consumer), more specifically in the Portuguese hams. Similar to the previous case study, you could remind the participants that first the key actors and production steps should be identified(slide #18).

You could highlight that in the processing stage, carcasses are collected from slaughterhouses and cut into meat pieces (e.g., the legs to become ham) for processing. After the ham is produced, a unique identification number is given to the product. Therefore the traceable resource unit for this case study can be thought of as the ham (slide #20).

In slide # 21, you could remind the participants that the context of design steps can slightly vary based on the design requirements/aims. For instance in this case study it is mentioned that they developed a web application for manual data entry. However, in the previous case study it was done both automatically via IoT and manually.

Slide #22 shows the identification and classification of requirements of the blockchain-based traceability system design similar to the previous example.

In slide #23, you can stress that the defined requirements in the previous step are translated into a distributed trust architecture with specific infrastructure characteristics through defining layers.

In this case study, the users and their allowances in the system as a part of building architectural design are also defined (slide #24). You could use the given table while summarizing.

As similar to the previous case study, you could highlight that the suitability of blockchain for the selected supply chain is checked and the most suitable blockchain technology is determined based on the collected information so far (slide #25). At the end of the tailoring step, Hyperledger Fabric is selected as blockchain technology, and they decided to use permissioned/private network architecture. The chosen consensus mechanism is not specifically mentioned in this case study.

Followingly, you could stress that the designed system`s performance is evaluated by using the performance monitoring method with real data (slide #26) which is one of the introduced methods in lesson 5.

After case study 2, you can start summarizing the benefits and the faced challenges of blockchain implementation examples through slides #27-28

You could highlight that apart from the encountered challenges in the examples, some other challenges and limitations have been discussed in the literature and summarize them through slide #29.

In slide #30 you could ask the participants to answer the formative questions.

On slide 32, you can use the course overview to summarize what and why the participants have learned during this course.

Relevant Readings

- It is recommended that the trainer look through the following book;

Luning, P. A., & Marcelis, W. J. (2020). Food quality management: technological and managerial principles and practices. In Food Quality Management. Wageningen Academic.

- It is also recommended to check the further reading list provided in the lesson slides. These lists may contain useful resources that can be used to interact with trainees.
- In lesson 3, the following articles were used in the case studies;

1) Regattieri, A., Gamberi, M., & Manzini, R. (2007). Traceability of food products: General framework and experimental evidence. Journal of Food Engineering, 81(2), 347-356.
2) Chen, T., Ding, K., ShuaiKang, H., GenDao, L., & JingYe, Q. (2020). Batch-based traceability for pork: a mobile solution with 2D barcode technology. Food Control, 107.

- In lesson 6, the following articles were used in the case studies;

1) Yang, X., Li, M., Yu, H., Wang, M., Xu, D., & Sun, C. (2021). A trusted blockchain-based traceability system for fruit and vegetable agricultural products. IEEE Access, 9, 36282-36293.
2) Arvana, M., Rocha, A. D., & Barata, J. (2023). Agri-Food Value Chain Traceability Using Blockchain Technology: Portuguese Hams' Production Scenario. Foods, 12(23), 4246.

Course Provider / Contact Details

Comments and inquiries may be addressed to Food Quality and Design, Wageningen University, fqd.office@wur.nl

Course #13: Blockchain Applications for Food Quality Assurance and Certification

Content and Duration

The lessons provided with the course "Blockchain Applications for Food Quality Assurance and Certification" are as follows:

Lesson 1: Introduction to Food Quality Assurance and Certification

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

Lesson 3: Blockchain Application for Milk Quality Assurance and Certification

Lesson 4: Blockchain Application for Honey Quality Assurance and Certification

Lesson 5: Blockchain Application for Wine Quality Assurance and Certification

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

Approx. 4 hours and 45 minutes to complete.

Objective

The objective of this course is to provide to interested participants, with a particular focus on SMEs owners, managers, and employees in the FSC, the knowledge and practical skills necessary to understand, implement, and leverage blockchain technology for enhancing food quality assurance and respond to certification processes. The FSC is a complex network of interconnected activities, processes, and entities involved in the production, processing, distribution, and consumption of food products. It includes all the stages and intermediaries through which food travels from the initial point of production to the final point of consumption. More specifically, the FSC involves numerous stakeholders, including producers, processors, distributors, retailers, regulatory authorities, and consumers. Therefore, the FSC is a critical component of the food industry and plays a significant role in ensuring that food products reach consumers safely and efficiently. Blockchain technology is increasingly being used to enhance transparency, traceability, and trust in the FSC. Therefore, the main goal of this course focuses on gaining a good understanding of how blockchain technology is applied in the FSC for food quality assurance and certification. More specifically, the first lesson provides familiarization with the notions of food quality assurance and food quality certification under the light of the FSC. With the second lesson attendees will gain familiarity with the utilization of blockchain technology in ensuring food quality and certification, particularly within the framework of the FSC by a step-by-step process to identify stakeholders in FSC. The following four lessons provide how the step-by-step process is applied for four different case studies, namely the milk, honey, wine, and olive oil supply chains.

Learning Outcomes

What your trainees will learn:

- 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).

Course Level - Education Level Required - Prerequisites

Beginners, Professional Development or Continuing Education

High School Diploma or Equivalent

Supply chain basics, basic understanding of certification processes, background in agriculture and/or food science.

Target Audience

Agrifood company employees and food supply chain personnel, logistics companies, university students, university graduates, business managers, business owners.

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Introduce yourself (few words about your background and expertise)

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to FSC and the applications of blockchain.

Create a concise map of expertise, skills, and experiences, that exist within your audience. This will help you to create groups for peer learning (e.g., mix IT with supply chain backgrounds) as well as to personalize the training experience.

As a scene setter, consider showing a information like this one: https://knowledge4policy.ec.europa.eu/food-fraud-quality/topic/food-fraud_en

Refer to real world relevance examples such as (taken from the picture above): “Did you know that in 2019, Europol seized a whopping 150 tons of sunflower oil falsely labelled as Olive Oil?“ (https://www.europol.europa.eu/media-press/newsroom/news/150-000-litres-of-fake-extra-virgin-olive-oil-seized-%E2%80%98well-oiled%E2%80%99-gang).

Also, that genuine Olive Oil from Apulia and Greece was sold as Protected Geographical Indication (PGI) Toscano?” (https://www.oliveoiltimes.com/business/europe/police-seize-counterfeit-tuscan-olive-oil/50778).

The goal is to attract the interest of trainees and to highlight the problem of food quality assurance and the need for solution.

Lesson 1: Introduction to Food Quality Assurance and Certification

Highlight that the food quality is a rather heterogeneous term because it is directly related to the individual perception of the consumer. Based on that statement you could start a discussion on what means for the participants the term “food quality”.

Provide the basics of food quality assurance and the notion of food certification. Make clear similarities and differences (i.e., both aim at improved food quality, however the first refers to internal processes while the later refers to external validation that a product or process meets specific standards or regulations).

Consider referring to the following key points: quality management systems and processes, regulatory compliance.

While at slide #7 ask about how safe they feel with the food they consume on a frequent basis. Select one or two products that have been referred and discuss about the potential vulnerabilities and contamination causes that make the product unsafe.

Specific examples of products you could consider mentioning are cow milk, olive oil, rice etc. You could choose cow milk to analyse further. Potential vulnerabilities and contamination causes could be antibiotics and/or other chemicals, poor hygiene, contaminated feed, or water, inadequate temperature while stored and transported.

Consider grouping participants with different backgrounds (IT, supply chain etc) and ask them to discuss on how familiar they are with quality assurance standards (e.g. ISO) and certifications (e.g., organic, PGO, PGI, TSG, Fairtrade). Depending on the responses you get, you might consider discuss the role of labelling for their food choices.

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

Explain the fact that the blockchain technology has been increasingly used in the FSC to ensure transparency and traceability, which is becoming an important issue for ensuring food safety.

Explain to your trainees that this lesson will help them to gain familiarity with the utilization of blockchain technology in ensuring food quality and certification, particularly within the several stages of the FSC.

Before proceeding, make sure that trainees have a common understanding of key concepts, i.e. FSC and Blockchain.

When completed with slide #5 ask about how your trainees imagine the ideal food products and a FSC that they make them feel safe and that they trust. Specific examples of products could set a discussion basis.

Slides #9 to #12, focus on food quality assurance. It is important here to combine with the knowledge provided in previous lesson regarding food quality assurance with ISO standards. Moreover, it worths mentioning that this is not a solution that fits all and different products may require different approaches and solutions.

Slides #13 to #15, focus on food certification. Likewise, it is important here to combine with the knowledge provided in previous lesson regarding food certification (organic, PGO, PGI, TSG, Fairtrade).

Slides #16 to #21 provide a step-by-step process that is applied for selected case studies. Make sure that each of these stages are clear and that they can utilize for a given supply chain for both food quality assurance and certification.

Lesson 3: Blockchain Application for Milk Quality Assurance and Certification

You could start the presentation of the milk case study by briefly discussing the following article “Recent food safety and fraud issues within the dairy supply chain (2015–2019)” (https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7561604/). Explain to your trainees the importance of milk in several aspects (e.g. consumption, production, employment sector).

Consider grouping participants with different backgrounds (IT, supply chain etc.) and ask them to analyse the cow milk supply chain based on the previous lessons. They may also identify the quality problems that may occur at each stage.

When at slide #13 make a review of the whole milk supply chain for certification. Likewise, this supply chain could cover ISO standards. Moreover, it is important to make clear that other types of milk may have differences in their supply chain (e.g., sheep and goat milk).

Additionally, other milk products such as yogurt and cheese may also have differences in their supply chains.

Associate with each one of the cow milk supply chain stakeholders with causes of quality issues. For example, in the dairy farm this could be antibiotics, contaminated feed, or water, poor hygiene etc, during transportation to processing facility it could be inadequate temperature, poor hygiene etc., in the milk processing facility it could be inadequate pasteurization temperature, poor hygiene, mixing with other milks etc), during transportation to retail store it could be inadequate temperature, poor hygiene etc., in the retail store it could be inadequate temperature, poor hygiene etc.

Lesson 4: Blockchain Application for Honey Quality Assurance and Certification

You could start the presentation of the honey case study by briefly discussing the following article "Food fraud: How genuine is your honey?" (https://joint-research-centre.ec.europa.eu/jrc-news-and-updates/food-fraud-how-genuine-your-honey-2023-03-23_en). Emphasise on the "Improved, harmonised and generally accepted analytical methods are needed to increase the capability of official control laboratories to detect honey adulterated with sugar syrups.", from the section "Better detection capability". Explain to your trainees the importance of beekeeping in several aspects (e.g. consumption, production, employment sector).

Consider grouping participants with different backgrounds (IT, supply chain etc.) and ask them to analyse the honey supply chain based on the previous lessons. They may also identify the honey quality problems that may occur at each stage.

When at slide #13 make a review of the whole honey supply chain for certification. Likewise, this supply chain could cover ISO standards. Moreover, it is important to make clear that depending on the flowering and the pollen source (e.g. trees, flowers) as well as other beekeeping products like propolis and royal jelly, the supply chain may be different or modified.

Associate with each one of the honey supply chain stakeholders with causes of quality issues. Focus on slides #21 - #29 to highlight the advantages of using the Blockchain technology for traceability and transparency in the honey supply chain. The "Honeygate: How Europe is being flooded with fake honey" (https://www.euractiv.com/section/agriculture-food/news/honey-gate-how-europe-is-being-flooded-with-fake-honey/) could remind and set the basis for justifying the importance for traceability and transparency.

Lesson 5: Blockchain Application for Wine Quality Assurance and Certification

Explain to your trainees the importance of the wine industry for the economy of several countries. You could focus on the popularity of this product in terms of consumption as well as the health problem that may occur because of low quality. Inform the trainees that they will become familiar with how blockchain technology contributes to ensuring the quality and certification of wine.

The "Europe's valuable wine and beer industries are working to retain their competitive edge with an expanded range of aromas and blockchain-based fraud prevention." (https://projects.research-and-innovation.ec.europa.eu/en/horizon-magazine/extra-flavour-and-fraud-prevention-menu-europes-beer-and-wine-industries) could trigger a discussion regarding the wine quality issues.

Consider grouping participants with different backgrounds (IT, supply chain etc.) and ask them to analyse the wine supply chain based on the previous lessons, their experiences and vineyard location. They may also identify the quality problems that may occur at each stage (e.g., discuss impacts on quality with longer transportation times when vineyards are in mountainous areas).

When at slide #13 make a review of the whole wine supply chain for certification. Likewise, this supply chain could cover ISO standards. Moreover, it is important to make clear that other grapes-based wines and spirits may have differences in their supply chain. At this point it is valuable to mention again that the blockchain technology is not a solution that fits for all FSC.

Associate with each one of the wine supply chain stakeholders with causes of quality issues. Focus on the data that need to be stored in the blockchain to succeed transparency and traceability in the wine supply chain (slides #22 – 27).

The article "A Smart-Contract Enabled Blockchain Traceability System Against Wine Supply Chain Counterfeiting" (https://link.springer.com/chapter/10.1007/978-3-031-16407-1_56) could expand the discussion among the trainees by focusing on the technological part (i.e., smart contracts).

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

You could start this lesson by sharing the fact that olive oil was valued so highly at one point that was used as currency and that it is also known as "liquid gold," a term made popular by the great Ancient Greek writer Homer.

Consider grouping participants with different backgrounds (IT, supply chain etc.) and ask them to analyse the olive oil supply chain based on the previous lessons. They may also identify the quality problems that may occur at each stage. The article "Enhancing the

competitive advantage via Blockchain: an olive oil case study" (https://www.sciencedirect.com/science/article/pii/S2405896322002397) could help focusing on the "competitive advantage" that the blockchain technology offers.

When at slide #13 make a review of the whole olive oil supply chain for certification. Likewise, this supply chain could cover ISO standards. Moreover, it is important to make clear that other types of oil (e.g., sunflower, maize, soya) or other types of products such as olives may have differences in their supply chain.

Associate with each one of the olive oil supply chain stakeholders with causes of quality issues. In this lesson highlight that the Blockchain technology can guarantee that the final product is organic, PGO, PGI, has been produced following sustainable practices, quality standards (e.g., ISO).

Relevant Readings

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Course Provider - Contact Details

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Course #14: ESG and SDGs in Food Supply Chain using Blockchain Technology

Content and Duration

The lessons provided with the course "ESG and SDGs in Food Supply Chain using Blockchain Technology" are as follows:

Lesson 1: Introduction to ESG and SDGs

Lesson 2: The Role of Blockchain in ESG and SDGs

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

Lesson 4: Practical case studies of Blockchain application for ESG and SDG

Lesson 5: Implications and Future Trends

Approx. 3 hours to complete.

Objective

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.

Grasp the fundamentals: Define and explain ESG, SDGs, and their significance in the context of the food supply chain.

Comprehend the role of blockchain: Analyze how blockchain technology enhances transparency, traceability, and compliance with ESG and SDG goals within the food supply chain.

Apply practical knowledge: Evaluate real-world case studies demonstrating how blockchain is used for monitoring, reporting, and verifying ESG and SDG performance in the food supply chain.

Navigate the regulatory landscape: Understand the regulatory environment surrounding ESG and SDGs in the food supply chain and how blockchain can facilitate compliance.

Analyze stakeholder impact: Assess the implications of implementing blockchain for ESG and SDGs on diverse stakeholders within the food supply chain.

Anticipate future trends: Identify emerging trends and future applications of blockchain technology for advancing ESG and SDGs in the food supply chain.

Learning Outcomes

Define and explain key terms like ESG, SDGs, traceability, transparency, and blockchain technology.

Describe the relevance of ESG and SDGs to the food supply chain.

Explain how blockchain technology enhances transparency and traceability in the food supply chain.

Identify the role of blockchain in promoting sustainable agricultural practices.

Analyze the regulatory environment surrounding ESG and SDGs in the food supply chain.

Discuss the benefits and challenges of implementing blockchain for ESG and SDG monitoring in the food industry.

Recognize emerging trends and future applications of blockchain for ESG and SDGs in the food supply chain.

Course Level, Education Level Required, and Prerequisites

Beginners, Professional Development or Continuing Education

High School Diploma or Equivalent

Economics basics.

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees and food supply chain personnel

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Introduce yourself (few words about your background and expertise)

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to FSC and the applications of blockchain.

Create a concise map of expertise, skills, and experiences, that exist within your audience. This will help you to create groups for peer learning (e.g., mix IT with supply chain backgrounds) as well as to personalize the training experience.

The learning method adopted that deviates from the conventional method of just a trainer led training allows you for interaction and feedback while utilizing the material hosted on the online platform as a tool.

You can adapt the material to suit the individual needs of your participants and the human element present generates questions and collaboration among their peers.

By providing real-time, personalized instructions amplify the result of the learning process.

Immediate feedback and interaction with your audience will assist you in providing them a deeper understanding.

A set of methods for engagement are being explained below in order for you to be prepared. Additional to them, and to the preparation above, make sure to introduce the gamification elements through the quizzes that are included in all lessons.

Lesson 1: Introduction to ESG and SDGs

This lesson dives into the exciting world of ESG and SDGs. Here are some suggestions to make the learning experience informative and engaging:

Engaging Delivery:

Interactive Introduction: Begin with an engaging activity to spark learners' interest. This could involve a short quiz on food waste or a real-world scenario highlighting ethical sourcing challenges.

Clear Definitions: Provide clear and concise definitions of ESG (Environmental, Social, and Governance) and SDGs (Sustainable Development Goals) with relevant examples. Utilize visuals like infographics or short videos to enhance understanding.

Relatable Examples: Connect the abstract concepts of ESG and SDGs to the food supply chain. Use relatable examples - pollution from agriculture, worker rights in food processing, or sustainable packaging - to demonstrate their practical application within the industry.

Deepen Understanding:

Relevance Discussion: Facilitate a discussion on the relevance of ESG and SDGs to the food industry. Encourage learners to identify challenges and opportunities for promoting sustainability within the food supply chain.

Interactive Activities: Incorporate interactive activities like group discussions or polls to assess learners' understanding. Present case studies with different ESG or SDG goals, and ask learners to discuss how companies can address them.

Connecting to the Course:

Bridge to Blockchain: Conclude the lesson by bridging the concepts of ESG and SDGs to the role of blockchain technology. Explain how blockchain can address challenges related to transparency and traceability, linking these concepts to the next lesson's focus.

Q&A and Preview: Allocate ample time for questions and address any misconceptions. Briefly preview the upcoming lesson on the role of Blockchain in ESG and SDGs, building anticipation for the practical applications covered.

Lesson 2: The Role of Blockchain in ESG and SDGs

This lesson delves into the fundamentals of the Role of Blockchain in ESG and SDGs. Here are some suggestions to make it informative and engaging:

Engaging Introduction:

Capture Attention: Begin with a thought-provoking question or real-world scenario highlighting a challenge in the food supply chain, like food waste or unethical sourcing.

Define Key Terms: Provide clear and concise definitions of ESG (Environmental, Social, and Governance) and SDGs (Sustainable Development Goals) with relevant examples.

Bridge to Blockchain: Briefly introduce blockchain technology and its potential to address these sustainability challenges. Mention its core features like immutability, traceability, and decentralization.

Deepen Understanding

Challenge Discussion: Facilitate a group discussion on the current challenges faced in implementing ESG and SDG initiatives within the food supply chain.

Blockchain Solutions Exploration: Delve deeper into blockchain's core features (immutability, traceability, decentralization) and how they address these challenges.

Real-World Case Studies: Showcase successful case studies where blockchain has been implemented for ESG and SDG goals in the food industry (e.g., sustainable sourcing, carbon footprint tracking).

Connecting to the Course

Benefits and Impact Analysis: Discuss the benefits blockchain brings to ESG and SDGs in the food supply chain, such as increased transparency, efficiency, and stakeholder trust.

Challenges and Expertise Discussion: Acknowledge the potential challenges of adopting blockchain (technical complexity, integration) and the importance of technical and domain expertise.

Looking Ahead: Briefly preview the next lesson's topic (e.g., specific blockchain applications in ESG and SDG areas) to build anticipation.

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

This lesson dives into the Institutional mechanisms surrounding ESG and SDGs in Food Supply Chain. Here are some suggestions to make it informative and engaging:

Deepen understanding of institutional mechanisms and economic theories:

Actively engage participants: Facilitate discussions around real-world examples of how institutional mechanisms (laws, regulations, norms) influence ESG & SDG compliance in the food supply chain.

Bridge the gap between theory and practice with blockchain technology:

Interactive simulations: Develop simulations where participants can experience the inefficiencies of traditional supply chains and then explore how blockchain technology improves transparency, traceability, and compliance with ESG & SDG standards.

Case studies: Present case studies of companies using blockchain in the food supply chain to address specific sustainability challenges.

Hands-on workshops: Offer optional workshops for participants to gain practical skills in using blockchain technology to analyze food supply chain data.

Foster collaboration and innovation for a sustainable future:

Group projects: Assign group projects where participants develop proposals for collaborative structures (partnerships, consortiums, DAOs) that utilize blockchain to promote sustainable practices in the food supply chain.

Industry expert panel: Organize a panel discussion with representatives from different stakeholders in the food supply chain (farmers, processors, retailers, consumers) to discuss challenges and opportunities for collaboration.

Innovation showcase: Dedicate time for participants to showcase innovative ideas or existing initiatives related to sustainable food supply chains and how they can be further strengthened.

Reinforce Community & Summarize Key Points:

Highlight the importance of community engagement for additional tokens and insights.

Briefly summarize key takeaways (benefits, responsible usage, community).

Include a formative assessment question to gauge understanding.

Lesson 4: Practical case studies of Blockchain application for ESG and SDG.

This lesson delves into the world Practical case studies of Blockchain application for ESG and SDG. Here are some suggestions to make it informative and engaging:

Enhance Existing Material with Active Learning Strategies:

Case Study Annotations: Encourage participants to actively analyze provided case studies (Everledger, IBM Food Trust, etc.) by adding annotations directly within the learning management system. This could involve highlighting key points, adding questions, or proposing alternative solutions.

Online Discussion Prompts: Embed discussion prompts within the lesson materials for each case study. These prompts should encourage critical thinking and analysis of how Blockchain addresses ESG and SDG challenges.

Interactive Quizzes based on Case Studies: Develop short quizzes embedded within the lesson material that test participants' understanding of the presented case studies. These quizzes can be designed using the existing information and various question formats like multiple-choice or open-ended.

Bridge Theory and Practice with Practical Applications:

Comparative Analysis: Present participants with a selection of real-world supply chain challenges. Ask them to analyze how different Blockchain platforms (e.g., IBM Food Trust, BanQu) could be used to address each challenge.

Case Study Dissection: Guide participants through a step-by-step process of dissecting a case study. This could involve identifying the specific ESG/SDG goals, analyzing the limitations of traditional solutions, and then evaluating how Blockchain addresses those limitations.

Foster Collaboration and Innovation for a Sustainable Future:

Group Projects: Assign group projects where participants develop proposals for using Blockchain to promote collaboration among stakeholders in a specific industry (e.g., farmers, retailers, consumers) to achieve a shared ESG or SDG goal.

You can encourage participants to conduct their own research using external sources to supplement their understanding of specific aspects of Blockchain, ESG, or SDGs. This can lead to richer discussions and project proposals.

Lesson 5: Implications and Future Trends.

This lesson delves into the Implications and Future Trends. Here are some suggestions to make it informative and engaging:

Deepen Understanding Through In-Depth Analysis:

Case Study Challenges Analysis: After presenting each case study (Walmart, IBM & Maersk, etc.), guide participants through a structured analysis of the challenges outlined in the lesson material. Encourage them to use the information presented on "Challenges of ESG and SDGs in Food Supply Chain" to analyze how these challenges played a role in the specific case studies.

Text Annotation and Discussion: Utilize the annotation feature within the learning platform (if available) to encourage participants to highlight key points and challenges related to ESG and SDGs within existing lesson materials. Facilitate online discussions where participants can share their annotations and engage in a deeper analysis of the presented information.

Comparative Analysis of Challenges: Using existing material, encourage participants to compare and contrast the challenges faced by different stakeholders (farmers, consumers, policymakers) in adopting blockchain for ESG and SDG goals in the food supply chain. They

can analyze the "Challenges of ESG and SDGs in Food Supply Chain" section for each stakeholder perspective.

Foster Critical Thinking Through Existing Resources:

Self-Directed Research Prompts: Based on the information presented in the lesson materials, particularly "Emerging Trends and Future Applications," develop prompts that encourage participants to conduct self-directed research on specific trends. This could involve researching existing pilot projects or initiatives related to those trends.

Discussion Prompts Based on Case Studies: Create discussion prompts based on the case studies that challenge participants to consider the potential impact of future trends on the specific companies or initiatives presented. For example, how could hyper-transparency (mentioned in "Emerging Trends and Future Applications") impact the operations of Walmart or Provenance?

Debate with Existing Information: Frame a debate using existing information on challenges and benefits. Participants can argue for or against a statement like: "Despite the challenges outlined in the course material, blockchain has the potential to revolutionize the food supply chain for a more sustainable future." They can reference specific examples from the lesson materials to support their arguments.

Encourage Reflection and Action with the Existing Material:

Reflection Prompts on Sustainability Goals: Based on the information presented on ESG and SDGs, develop reflection prompts that encourage participants to consider how blockchain technology could contribute to achieving specific SDGs in the food supply chain. They can reference "Emerging Trends and Future Applications" for potential solutions.

Action Planning based on Lesson Learnings: Guide participants through an action planning exercise using the existing information. Encourage them to identify actions they can take in their professional roles to promote awareness and adoption of blockchain for ESG and SDG goals in the food supply chain, even with the existing challenges.

Course Material Review and Synthesis: Dedicate time for participants to revisit key takeaways from the lesson materials, particularly "Summary & Key Takeaways" section. Encourage them to synthesize their learnings and identify the most promising future trends for blockchain in achieving ESG and SDG goals within the food industry.

Relevant Readings

Lesson 1: Introduction to ESG and SDGs

Food and Agriculture Organization of the United Nations (FAO). (2023). The State of Agricultural Commodity Markets. https://www.fao.org/publications/home/fao-flagship-publications/the-state-of-agricultural-commodity-markets/en

World Business Council for Sustainable Development (WBCSD). https://www.wbcsd.org/

Lesson 2: The Role of Blockchain in ESG and SDGs

World Economic Forum. (2020, September 3). How Blockchain Can Help Us Achieve the SDGs. https://www.weforum.org/agenda/2020/09/3-ways-blockchain-can-contribute-to-sustainable-development/

IBM Food Trust. (n.d.). A secure and transparent global food ecosystem. https://www.ibm.com/products/supply-chain-intelligence-suite/food-trust

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

The Global Alliance for Improved Nutrition (GAIN). (n.d.). Blockchain for a More Sustainable Food System. https://www.gainhealth.org/

The Food and Land Use Coalition. https://www.foodandlandusecoalition.org/

Lesson 4: Practical case studies of Blockchain application for ESG and SDG

Provenance. (n.d.). About. https://www.provenance.org/

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Lesson 5: Implications and Future Trends

The Brookings Institution. (2023). Blockchain for Climate Action. https://www3.weforum.org/docs/WEF_Blockchain_for_Scaling_Climate_Action_2023.pdf

McKinsey & Company. (2023, March 29). The Future of Food: How New Technologies Are Transforming the Way We Shop and Eat. https://www.mckinsey.com/~/media/mckinsey/email/rethink/2023/03/2023-03-29d.html

Course Provider / Contact Details

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Course #15: Climate Action, Energy transition and Blockchain in Food Supply chain

Content and Duration

The lessons provided with the course “Climate Action, Energy transition and Blockchain in Food Supply chain.” are as follows:

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

Lesson 2: Blockchain for Green Energy transition

Lesson 3:Blockchain for Life Cycle Assessment (LCA)

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

Lesson 5: Sustainable Agriculture and Smart Farming Practices

Lesson 6:Environmental impact of Blockchain technology

Approx. 3 hours to complete.

Objective

Equip participants with the knowledge and skills to leverage Blockchain technology for achieving climate action, energy transition, and a more sustainable food supply chain. This objective captures the essence of the course by highlighting the following key points:

Knowledge: Participants will gain a comprehensive understanding of the Climate-Energy-Food nexus and the importance of sustainable agriculture in a changing climate.

Skills: The course will equip participants with the ability to design and implement Blockchain solutions to support net-zero transition within the food supply chain.

Focus on Sustainability: The objective emphasizes the application of Blockchain technology for positive environmental impact within the food sector.

Alignment with Course Content:

The course content directly supports this objective, with each lesson contributing specific knowledge and skills:

Lessons 1 & 3: Establish the foundation with the Climate-Energy-Food nexus and Blockchain's role in Life Cycle Assessment (LCA).

Lessons 2 & 4: Focus on the application of Blockchain for green energy transition and Measurement, Reporting, and Verification (MRV) systems.

Lesson 5: Provides knowledge on sustainable agriculture practices that integrate well with Blockchain.

Lesson 6: Ensures a balanced perspective by addressing the environmental impact of Blockchain technology itself.

Learning Outcomes

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

- Explain the interconnected nature of climate change, energy use, and food production systems (Climate-Energy-Food Nexus).
- Describe the potential of Blockchain technology to revolutionize traceability, transparency, and sustainability within the food supply chain.
- Discuss the importance of sustainable agricultural practices in mitigating climate change and explore their synergy with Blockchain solutions.
- Identify the environmental benefits and drawbacks associated with Blockchain technology.
- Analyze a food supply chain to identify areas where Blockchain technology can be implemented for improved sustainability.
- Apply basic Blockchain concepts to design solutions that support net-zero emissions goals within the food sector.
- Evaluate the strengths and weaknesses of existing Blockchain applications in the food supply chain.
- Communicate effectively the potential of Blockchain technology for climate action and energy transition within the food industry.
- Appreciate the urgency of climate action and the role of innovation in achieving a sustainable food system.
- Foster a critical and questioning approach towards emerging technologies like Blockchain.
- Recognize the importance of collaboration between stakeholders across the food supply chain for successful implementation of Blockchain solutions.
- Demonstrate a commitment to continuous learning and staying updated on advancements in Blockchain technology for sustainability.

Course Level, Education Level Required, and Prerequisites

Beginners, Professional Development or Continuing Education

High School Diploma or Equivalent

Economics basics.

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees and food supply chain personnel

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviourism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Introduce yourself (few words about your background and expertise)

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to FSC and the applications of blockchain.

Create a concise map of expertise, skills, and experiences that exist within your audience. This will help you to create groups for peer learning (e.g., mix IT with supply chain backgrounds) as well as to personalise the training experience.

The learning method adopted that deviates from the conventional method of just a trainer led training allows you for interaction and feedback while utilising the material hosted on the online platform as a tool.

You can adapt the material to suit the individual needs of your participants and the human element present generates questions and collaboration among their peers.

By providing real-time, personalised instructions amplify the result of the learning process.

Immediate feedback and interaction with your audience will assist you in providing them a deeper understanding.

A set of methods for engagement are being explained below in order for you to be prepared. Additional to them, and to the preparation above, make sure to introduce the gamification elements through the quizzes that are included in all lessons.

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

This lesson dives into the topic “Blockchain for Environmental Impact and Sustainability in the Food Supply Chain”. Here are some suggestions to make the learning experience informative and engaging:

Optimizing Course Material for Online Learning

Leverage Headings and Bullet Points: Utilize the existing headings and bullet points within the course material to structure online modules. This guides students through the information and improves readability.

Highlight Key Concepts: Identify key takeaways and definitions throughout the text. Bold them, or present them as separate bullet points for emphasis.

Focus on Benefits throughout the Material: Integrate the "Think Food. Think Safety. Think Impact." section strategically throughout the course. Encourage students to connect the challenges raised to how blockchain offers solutions.

Fostering Engagement with Existing Material

Discussion Prompts: Based on the course material, create discussion prompts for online forums. Examples include: "How does blockchain's transparency improve food traceability compared to paper-based systems?" or "What trade-offs (e.g., cost vs. sustainability) do you see with blockchain in the food industry?"

Case Study Analysis: Present the case studies (like BRUSCHETTA) within the online modules and ask students to analyze them directly using the text. Guide them with questions like "How does the BRUSCHETTA platform demonstrate blockchain's role in food safety?"

Interactive Quizzes: Create online quizzes using the existing information. Utilize multiple-choice, matching, or true/false questions to assess student understanding of key concepts presented in the course material.

Lesson 2: The Role of Blockchain in ESG and SDGs

This lesson delves into the fundamentals of theBlockchain for Green Energy transition. Here are some suggestions to make it informative and engaging:

Content Structure and Delivery

Break down lengthy text sections into smaller, focused modules with clear headings.

Emphasize key takeaways by bolding or underlining them within each section. Reiterate these points during lectures or presentations.

Briefly summarize the connection between modules at the end of each section to demonstrate how the course material builds upon itself.

Emphasize EU Green and Digital Transition

Integrate concrete examples from the lesson material, like the Guarantees of Origin mechanism, while explaining the EU strategy. Discuss how blockchain can improve its efficiency and transparency.

Clearly highlight how blockchain's features specifically address the EU's goals (e.g., transparency, sustainability) within the green and digital transition strategy. Provide real-world applications to illustrate these connections.

Fostering Active Learning with Existing Material

Use the existing case study (BRUSCHETTA) to spark discussions. Ask students how blockchain can be applied in similar contexts within the agri-food sector. Encourage them to brainstorm practical applications.

Consider incorporating some of the existing formative assessment questions into activities or discussions to gauge student comprehension of key concepts (This step is optional).

Explore the possibility of incorporating interactive elements related to the visuals (like images, charts) to enhance engagement (This step is also optional, depending on the auditory request).

Lesson 3: Blockchain for Life Cycle Assessment (LCA).

This lesson dives into the topic “Blockchain for Life Cycle Assessment (LCA)”. Here are some suggestions to make it informative and engaging:

Content Structure and Delivery

Chunking Content: Break down the lengthy text sections into smaller, focused modules with clear headings. Each module should ideally align with a specific learning objective.

Visual Aids: Incorporate visuals (images, graphs, charts) throughout the modules to enhance understanding and break up text-heavy sections.

Interactive Elements (Optional): Explore incorporating interactive quizzes or activities within each module to reinforce key points and gauge student comprehension.

Emphasize Key Concepts and Applications

Bold Key Terms: Use bold or underline to highlight key terms and concepts within each module.

Real-World Examples: Integrate the real-world examples of LCA and blockchain collaboration (Nestle, Unilever, Danone) throughout the course to illustrate the practical applications of the concepts.

Focus on Online Learner Engagement: Consider using short video clips or case studies related to the examples to keep online learners engaged.

Leverage Existing Material for Assessment

Formative Assessments (Adapted): Adapt the existing formative assessment question into a short online quiz or discussion prompt within the relevant module.

Learning Activities: Develop learning activities based on the lesson material, such as analyzing LCA data from existing databases (Poore & Nemecek, SHARP-ID, SU-EATABLE LIFE) to compare environmental impacts of different products.

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

This lesson delves into the topic “Blockchain for Measurement, Reporting, and Verification (MRV)”. Here are some suggestions to make it informative and engaging:

Activity-Based Learning for Online Environment

Leverage Existing Quizzes: Utilize the existing formative assessment questions as the foundation for short online quizzes after each key concept section (e.g., MRV, GHG Protocol, VCM).

Interactive Discussions: Encourage online discussions after each section based on the existing questions. The trainer can provide prompts to stimulate student engagement (e.g., "How can improved MRV in agriculture benefit consumers?", "What are some potential drawbacks of the VCM?").

Real-World Examples and Case Studies

Supplement with Case Studies: Identify and incorporate case studies that showcase real-world applications of blockchain-based MRV in the food supply chain. These can be

integrated within the relevant sections (e.g., a case study on a coffee or chocolate company implementing blockchain-based emissions tracking).

Guest Speaker Option (Optional): If feasible, consider inviting a guest speaker working in the field of blockchain and sustainability in the food industry to share their insights and experiences.

Visual Storytelling

Pictures: Consider incorporating pictures from presentation to illustrate complex concepts like the Digital MRV Framework or the functioning of the EU ETS (Emission Trading System).

Lesson 5: Sustainable Agriculture and Smart Farming Practices.

This lesson delves into the Sustainable Agriculture and Smart Farming Practices. Here are some suggestions to make it informative and engaging:

Interactive Activities and Real-World Connections

Case Study Analysis: Dedicating more time to analyzing the case studies (AgroWatts, Raiz Farm) can be beneficial. The trainer can facilitate group discussions where students dissect the challenges, solutions, and key takeaways from each case.

Role-Playing Scenarios: Simulate real-world situations where farmers grapple with decisions on adopting smart farming technologies or implementing sustainable practices. This allows students to practice critical thinking and communication skills.

Emphasize Financial Benefits of Sustainability

Cost-Benefit Analysis: While the course covers profitability from smart farming, dedicating a specific session to cost-benefit analysis can be helpful. Showcasing concrete examples (e.g., ROI calculations) can convince students of the financial attractiveness of sustainable practices.

Market Differentiation Strategies: Discuss how blockchain-enabled traceability allows farmers to command premium prices for sustainably produced crops. Explore marketing strategies that leverage this transparency to target specific consumer segments.

Bridge the Knowledge Gap

Tech for Non-Tech Audience: Tailor explanations of smart farming technologies and blockchain to an audience that may not be familiar with these concepts. Use clear, concise language and provide visuals (animations, infographics) to enhance understanding.

Glossary of Terms: Create a glossary of technical terms used throughout the course. This allows students to easily revisit definitions and promotes better comprehension.

Lesson 6: Environmental impact of Blockchain technology.

This lesson delves into the Environmental impact of Blockchain technology. Here are some suggestions to make it informative and engaging:

Make the Complex Clear

Break Down Jargon: While the course covers essential technical terms, there may be students unfamiliar with blockchain or environmental concepts. Begin with clear definitions and avoid overly technical explanations.

Visual Aids: Utilize visuals (charts, infographics, animations) to illustrate complex topics like Proof of Work or the environmental impact of E-waste.

Real-World Examples: Ground the concepts in relatable situations. Use the case studies (IBM Food Trust, WWF) to showcase how blockchain tackles specific environmental challenges.

Focus on Solutions and the Future

Shift the Narrative: Acknowledge Bitcoin's environmental impact, but dedicate more time to solutions like Ethereum's Merge and greener consensus mechanisms.

Future Applications: Discuss promising applications of blockchain in sustainability initiatives. Explore areas like carbon offset tracking or ethical sourcing in the agri-food sector.

Guest Speaker: Invite a representative from a company like BanQu to discuss using blockchain for sustainable business practices.

Increase Engagement and Interaction

Interactive Activities: Incorporate quizzes, polls, or group discussions to check for understanding and boost engagement.

Case Study Analysis: Dedicate time for students to analyze the case studies (BanQu) in more depth. Encourage discussions on challenges, solutions, and potential applications in different industries.

Project-Based Learning: Consider a project where students research and present on a specific blockchain application for green energy transition. This allows them to apply their knowledge and develop critical thinking skills.

Relevant Readings

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

World Wildlife Fund (WWF). (n.d.). Blockchain for Conservation. https://techhub.wwf.ca/

This webpage explores how WWF is using blockchain technology to track tuna fishing and other initiatives to promote sustainable practices.

IBM Food Trust. (n.d.). Food Supply Chain Transparency. https://www.ibm.com/products/supply-chain-intelligence-suite/food-trust

This website details how IBM Food Trust is leveraging blockchain to create a transparent and accountable food supply chain.

World Business Council for Sustainable Development (WBCSD). (2020). Blockchain for a Sustainable Food System. https://www.wbcsd.org/

This report explores the potential of blockchain to transform the food system towards greater sustainability.

2. Blockchain for Green Energy Transition

Rocky Mountain Institute. (2021, September 21). How Blockchain Can Accelerate the Clean Energy Transition. https://rmi.org/blockchain-reimagining-rules-game-energy-sector/

This article explores various applications of blockchain in the energy sector, including renewable energy integration and peer-to-peer energy trading.

International Renewable Energy Agency (IRENA). (2019, September). Blockchain for the Energy Sector: A Potential Game Changer. https://www.irena.org/publications/2019/Sep/Blockchain

This report by IRENA examines the potential of blockchain to transform the energy sector and unlock new business models for renewables.

The Conversation. (2020, October 28). How blockchain can help us reach net-zero emissions. https://www.linkedin.com/pulse/how-blockchain-can-revolutionize-fight-against-global-dar-rto5f

This article explores how blockchain can be used to track carbon emissions and support carbon offset markets.

3. Blockchain for Life Cycle Assessment (LCA)

Minderhout, S., Circular Economy, Geissdoerfer, M., & Snow, E. (2017, January). Blockchain Technology and the Circular Economy: A Systematic Literature Review. ResearchGate, https://www.researchgate.net/publication/363218788_Blockchain_Technology_and_the_Circular_Economy_A_Systematic_Literature_Review

This report explores how blockchain can be used to track materials and products throughout their lifecycle, which is essential for LCA.

The Stockholm Environment Institute (SEI). (n.d.). Blockchain for Transparency in Life Cycle Assessment. https://www.sei.org/

This article discusses the potential of blockchain to improve transparency and data integrity in LCA studies.

4. Blockchain for Measurement, Reporting, and Verification (MRV)

Gold Standard. (2022, February 10). Gold Standard Announces Proposals to Allow Creation of Digital Tokens for Carbon Credits. https://www.goldstandard.org/

This webpage explores how Gold Standard is using blockchain to improve the monitoring, reporting, and verification (MRV) of climate action projects.

Institute of Chartered Accountants in England and Wales (ICAEW). (2020, September 29). Blockchain and Sustainability Reporting. https://assets.kpmg.com/content/dam/kpmg/pt/pdf/pt-websummit-blockchain-and-climate-reporting.pdf

This article explores how blockchain can be used to enhance the accuracy, transparency, and auditability of sustainability reporting, which relies on MRV data.

5. Sustainable Agriculture and Smart Farming Practices

Food and Agriculture Organization of the United Nations (FAO). (n.d.). Climate-Smart Agriculture. https://www.fao.org/climate-smart-agriculture/en/

This FAO webpage provides a wealth of information on climate-smart agriculture practices that can help mitigate and adapt to climate change.

The Rodale Institute. (n.d.). Regenerative Organic Agriculture. https://rodaleinstitute.org/why-organic/organic-basics/regenerative-organic-agriculture/

The Rodale Institute is a leading organization promoting regenerative organic agriculture practices that improve soil health, biodiversity, and climate resilience.

Course Provider / Contact Details

Comments and inquiries may be addressed to Leonid Khatskevych and Roman Kravchenko, 482.solutions - hello@482.solutions

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

Content and Duration

The lessons provided with the course “Blockchain Adoption Strategies for Small and Medium-sized Enterprises in the Food Sector” are as follows:

Lesson 1: Understanding the potential of blockchain technology for SMEs in the food sector.

Lesson 2: The challenges of blockchain adoption for SMEs in the food sector.

Lesson 3: Key Steps in Blockchain Adoption for SMEs in the food sector.

Lesson 4: Case Studies.

Approx. 3 hours to complete (including study time).

Objective

This course aims to equip participants with an understanding of the potential benefits and challenges associated with integrating blockchain technology in small and medium-sized enterprises within the food industry. The course investigates the transformative impact of blockchain in enhancing traceability, reducing fraud, and building consumer trust, while also addressing the technical and financial complexities inherent in its adoption. Participants will learn not only about the strategic importance of blockchain for compliance with food safety regulations but also about the pragmatic aspects of its implementation. This includes conducting a needs assessment, engaging stakeholders effectively, selecting the appropriate blockchain platform, and developing a comprehensive implementation strategy. Furthermore, the course provides real-world insights through case studies, highlighting successful blockchain implementations in the sector.

Learning Outcomes

What your trainees will learn:

- Understand the basic principles and benefits of blockchain technology for SMEs operating in the food industry.
- Identify methods used by blockchain to reduce fraud and ensure product authenticity.
- Analyse the role of blockchain in efficient SME inventory management.
- Evaluate the impact of blockchain on building consumer trust through transparency.
- Investigate the specific hurdles SMEs face in adopting blockchain, including financial and human resource limitations, technical expertise gaps, and integration challenges with current IT infrastructures.
- Examine the initial and ongoing costs associated with blockchain adoption, including hardware, software, network fees, and system maintenance costs.
- Explore the technical complexities of blockchain, such as scalability, performance issues, standardization, interoperability, and compatibility with legacy systems.

- Investigate various solutions to adoption challenges, including industry-wide and technical standards, partnerships, collaborations, and leveraging grants and funding opportunities.
- Learn how to assess whether blockchain technology aligns with business goals and technical capabilities, including technology understanding, business goal alignment, cost-benefit analysis, supply chain efficiency, regulatory compliance, partner and supplier readiness, technical feasibility, data privacy, and market dynamics.
- Learn the steps to develop a comprehensive strategy for blockchain implementation, including identifying use cases, developing a proof of concept, selecting the right platform, and deploying the technology effectively.
- Understand the importance of staff training and change management in the adoption of blockchain technology, focusing on addressing knowledge gaps and managing the organizational impact of this new technology.

Course Level - Education Level Required - Prerequisites

Beginners Level, Professional Development

High School Diploma or Equivalent

Consider this course as an advanced level of “Course 7: Basic Blockchain Skills”

Target Audience

Entrepreneurs and Business Owners in the Food Sector, Operations and Supply Chain Managers, IT and Technology Professionals in the Food Industry, Food Safety and Compliance Officers, Academics and Researchers

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners around blockchain adoption strategies for small and medium-sized enterprises in the food sector, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Interactive Ice-Breakers: Start with an ice-breaking session that is relevant to the course theme. For instance, a quick roundtable where each participant shares their experience or interest in blockchain technology or their expectations from the course. This not only breaks the ice but also aligns everyone's focus towards the subject matter.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Real-World Scenarios and Case Studies: Given the practical nature of the course, incorporate discussions around real-world scenarios and case studies. Encourage participants to share their experiences or hypothetical applications of blockchain in their work.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Visual Icebreakers: There are several visual “helpers” within the course that could help you stimulate the interest and discussions regarding blockchain adoption strategies for SMEs in the FSC. For example you could use (among others):

- The image in Lesson 1, slide 6, to explain how blockchain can enhance traceability in the FSC.

- The image in Lesson 2, slide 12, to provide an overview of the numerus technical complexities around blockchain and initiate a discussion about mitigation measures.
- The diagram presented in Lesson 3, slide 23 to present a possible implementation strategy and discuss with the participants the advantages and disadvantages of such strategy.

Instant Storytelling: Ask participants to share a quick story or thought about a food product, focusing on aspects like origin or traceability. This can lead to discussions about how blockchain and digital currencies could play a role.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Encourage Critical Thinking: Challenge participants with questions or scenarios that require critical thinking and analysis. This not only keeps them engaged but also deepens their understanding of the course material.

Lesson 1: Understanding the potential of blockchain technology for SMEs in the food sector

Begin by clearly stating the lesson's objectives. Emphasize the practical applications of blockchain in the food sector, aiming to demystify the technology for participants.

Use simple, non-technical language to explain blockchain's potential in enhancing traceability, reducing fraud, and improving inventory management.

Encourage questions to ensure participants grasp these fundamental concepts.

Use real-life examples to illustrate how blockchain brings transparency to supply chains.

Discuss common fraud types in the food sector and how blockchain addresses these.

Explain the challenges of traditional inventory management and how blockchain can offer solutions.

Illustrate how blockchain can streamline regulatory reporting and enhance compliance efficiency.

Conclude with a summary of the key benefits of blockchain for SMEs in the food sector.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Facilitate a brainstorming session on how transparency can boost consumer confidence.

Lesson 2: The challenges of blockchain adoption for SMEs in the food sector

Begin with an overview of the challenges SMEs typically face in adopting blockchain, grounding the discussion in real-world contexts.

Dive into the specifics of each challenge, such as limited resources, technical complexities, and regulatory hurdles like GDPR compliance.

Present the technical complexities in a manner that is accessible to non-technical participants.

Highlight the importance of understanding and complying with data protection laws, using GDPR as a key example.

After discussing the challenges, shift the focus to potential solutions and strategies like industry collaboration, funding opportunities, and education.

Discuss real-world examples and case studies that demonstrate how businesses have successfully navigated these challenges.

Conclude with a summary of the main challenges and solutions discussed in the lesson.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Facilitate an interactive session where participants can discuss the various costs associated with blockchain adoption, including initial investment and ongoing expenses.

Lesson 3: Key Steps in Blockchain Adoption for SMEs in the food sector

Begin by summarizing the lesson's objectives and its importance in guiding SMEs through the blockchain adoption process. Emphasize how this lesson will provide a detailed, step-by-step approach.

Discuss the importance of assessing blockchain feasibility, covering aspects like technical suitability, economic viability, and alignment with business objectives.

Explain the criteria for selecting the right blockchain platform, focusing on scalability, throughput, energy efficiency, and compliance.

Discuss the steps for developing a comprehensive blockchain implementation strategy.

Highlight the importance of staff training and effective change management when transitioning to a blockchain-based system.

Address regulatory requirements and data privacy concerns in blockchain implementation.

End with a summary of the lesson, emphasizing the strategic assessment and careful planning required for successful blockchain adoption.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Use a comparative approach to explain different blockchain platforms, highlighting their pros and cons.

Consider conducting a role-play or scenario-based activity to illustrate the challenges and strategies in managing organizational change.

Lesson 4: Case Studies

Begin with an overview of what case studies will be covered and why they are important for understanding practical applications of blockchain in the food sector.

For each case study (e.g., Kezzler, Ripe.io, TagOne, etc.), provide a detailed analysis of how the company implemented blockchain technology.

After presenting each case study, facilitate a discussion where participants can analyse the strategies used and the outcomes achieved.

Compare and contrast different case studies to highlight varied applications of blockchain in the food sector.

Use questions like *"What implementation impressed you the most and why?"* to encourage participants to critically engage with the material.

Summarize the main insights gained from the case studies and reinforce how these can be applied in practice.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Relevant Readings

- Vu, Nam, Abhijeet Ghadge, and Michael Bourlakis. "Blockchain adoption in food supply chains: A review and implementation framework." Production Planning & Control 34.6 (2023): 506-523.
- Ilbiz, Ethem, and Susanne Durst. "The appropriation of blockchain for small and medium-sized enterprises." Journal of Innovation Management 7.1 (2019): 26-45.
- Mohammed, Abubakar, et al. "Blockchain Adoption in Food Supply Chains: A Systematic Literature Review on Enablers, Benefits, and Barriers." IEEE Access (2023).
- Kumar Bhardwaj, Amit, Arunesh Garg, and Yuvraj Gajpal. "Determinants of blockchain technology adoption in supply chains by small and medium enterprises (SMEs) in India." Mathematical Problems in Engineering 2021 (2021): 1-14.
- Vu, Nam, Abhijeet Ghadge, and Michael Bourlakis. "Blockchain adoption in food supply chains: A review and implementation framework." Production Planning & Control 34.6 (2023): 506-523.

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

Comments and inquiries may be addressed to Stamatis Papangelou (papangelou.m@unic.ac.cy), University of Nicosia

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

Content and Duration

The lessons provided with the course "Ethical Considerations and Governance in Blockchain-enabled Food Supply Chains" are as follows:

Lesson 1: Introduction to Blockchain Technology in Food Supply Chains

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

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

Lesson 4: Social and Environmental Impacts of Blockchain Implementation

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

Approx. 3 hours to complete (including study time).

Objective

The course "Ethical Considerations and Governance in Blockchain-enabled Food Supply Chains" is designed to present the interplay of ethics, governance, and technology in the context of agrifood and food supply chains. It aims to equip participants with the skills to analyse and address the ethical implications of using blockchain in food supply chains, including issues related to fair trade, organic labelling, and animal welfare. Additionally, the course focuses on understanding the governance structures and decision-making processes necessary for the effective management of these supply chains. Participants will also explore the broader social and environmental impacts of blockchain technology, such as energy consumption and e-waste, and learn strategies to mitigate these effects. The course concludes with an examination of the current regulatory landscape, identifying the opportunities and challenges that lie ahead for the use of blockchain technology in the food business.

Learning Outcomes

What your trainees will learn:

- Understand the role and significance of blockchain technology in enhancing transparency, traceability, and trust within the food supply chain.
- Identify the benefits and challenges associated with implementing blockchain in food supply chains.

- Recognize blockchain's potential for enhancing ethical transparency in supply chains, particularly in addressing challenges within the food supply sector.
- Develop critical thinking skills to analyse how blockchain can be ethically utilized.
- Gain an understanding of on-chain and off-chain governance, including insights into centralized and decentralized control.
- Evaluate the effectiveness of different governance models in blockchain networks/projects.
- Understand blockchain's contributions to sustainability and its impact on social and environmental aspects.
- Discuss potential future directions for blockchain applications in supply chains, anticipating upcoming trends and developments.

Course Level - Education Level Required - Prerequisites

Professional Development, Continuing Education

Bachelor's Degree

Consider this course as an advanced level of "Course 1: Introduction to Blockchain Technology and Digital Assets" and "Course 3: MiCA Regulation and CBDC"

Target Audience

Professionals in Supply Chain Management, Blockchain Technology Enthusiasts, Sustainability and Ethics Officers, Regulatory and Compliance Professionals, Academics and Researchers

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners in the area of ethical and governance considerations in blockchain-enabled food supply chains, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Visual Icebreakers: There are several visual “helpers” within the course that could help you stimulate the interest and discussions regarding ethical considerations and governance in blockchain-enabled food supply chains. For example, you could use (among others):

- The illustration in Lesson 1, slide 9, to showcase the benefits of blockchain in FSC.
- The video present in Lesson 2, slide 12 to familiarize the participants with Building Blocks (BB)", an initiative by the United Nations World Food Programme (WFP).
- The video in Lesson 2, slide 16 and the video in Lesson 3, slide 18 to showcase some real world examples.

Instant Storytelling: Ask participants to share a quick story or thought about a food product, focusing on aspects like origin or traceability. This can lead to discussions about how blockchain and digital currencies could play a role.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Lesson 1: Introduction to Blockchain Technology in Food Supply Chains

Begin with a clear introduction to blockchain technology and its potential benefits in the food supply chain. Emphasize its role in enhancing transparency, traceability, and trust.

Elaborate on the key concepts of transparency, traceability, and trust, using real-world examples to illustrate their significance in the food supply chain.

Discuss the challenges of applying blockchain in the food supply chain, such as technical integration and standardization issues.

Conclude with a summary of the lesson, emphasizing the key points about blockchain's impact on the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

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

Begin by outlining the intersection of blockchain technology with ethical considerations in supply chains. Highlight the importance of ethics in blockchain applications. An engaging introduction could include asking participants to share their perceptions of ethics in technology.

Discuss blockchain's potential to support ethical objectives like fair trade, organic labelling, and animal welfare. Use real-world examples to illustrate these points.

Investigate case studies that showcase real-world examples of blockchain supporting ethical outcomes.

Conclude with a summary that encapsulates blockchain's role in promoting ethical practices within supply chains.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

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

Start with an overview of blockchain governance, explaining key terms like centralized and decentralized governance, on-chain and off-chain governance.

Discuss the differences between centralized and decentralized governance, on-chain and off-chain governance. Use comparative tables or diagrams for clarity.

Explain the roles of different stakeholders in blockchain governance, such as users, developers, nodes, and transaction validators.

Present case studies or examples that illustrate how governance decisions are made in real blockchain projects. Encourage discussion on these case studies, focusing on how governance models affect decision-making and project success.

Conclude with a summary of key points about blockchain governance and its impact on decision-making processes.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Consider conducting a role-play or group discussion activity where participants represent different stakeholders and debate a governance decision.

Lesson 4: Social and Environmental Impacts of Blockchain Implementation

Start with an overview that sets the context for how blockchain impacts society and the environment. Highlight the importance of understanding these impacts for responsible

blockchain implementation. Separate the discussion into the positive and negative impacts of blockchain technology.

Use real-world examples and case studies to illustrate these impacts, such as blockchain's role in energy efficiency versus its high energy consumption in some applications.

Discuss the complexities of measuring blockchain's energy consumption. Explain why this measurement is challenging and important.

Highlight how blockchain can contribute to sustainability efforts, such as tracking carbon emissions or supporting sustainable supply chains.

Conclude with a summary of the main social and environmental impacts of blockchain, emphasizing the balance between its potential benefits and drawbacks.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Consider utilize group discussions or debates, to explore the complexities of blockchain's environmental impact. This could include discussing the balance between blockchain's efficiency gains and its energy usage.

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

Begin with an overview of the regulatory environment for blockchain globally, with a focus on different regions like the EU, US, and Asia. Use the presentation slides to highlight key regulatory frameworks and developments in these regions.

Dive deeper into specific regulations such as the EU's MiCA framework, the US's approach to blockchain regulation, and the variability in regulations across Asian countries. Use the slides to provide detailed information while keeping the discussion interactive and engaging.

Discuss current guidelines and standards in the food supply chain relevant to blockchain, such as the Global Food Safety Initiative (GFSI) and the Food Safety Modernization Act (FSMA).

Explore potential future directions for blockchain in the food supply chain, focusing on technological advancements, policy interventions, and the need for international collaboration.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Relevant Readings

- Krzyzanowski Guerra, Kathleen, and Kathryn A. Boys. "A new food chain: Adoption and policy implications to blockchain use in agri-food industries." Applied Economic Perspectives and Policy 44.1 (2022): 324-349.
- Menon, Sheetal, and Karuna Jain. "Blockchain technology for transparency in agri-food supply chain: Use cases, limitations, and future directions." IEEE Transactions on Engineering Management (2021).
- Chandan, Anulipt, Michele John, and Vidyasagar Potdar. "Achieving UN SDGs in Food Supply Chain Using Blockchain Technology." Sustainability 15.3 (2023): 2109.

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

Comments and inquiries may be addressed to Marianna Charalambous, University of Nicosia, charalambous.mari@unic.ac.cy

Course #18: Combined Powers: Blockchain and Internet of Things in Transforming the Food Supply Chain

Content and Duration

The lessons provided with the course "Combined Powers: Blockchain and Internet of Things in Transforming the Food Supply Chain" are as follows:

Lesson 1: Fundamentals of Blockchain and IoT

Lesson 2: Combining Blockchain and IoT

Lesson 3: Blockchain and IoT: Integration Challenges

Lesson 4: Case Studies & Future Developments

Approx. 2.5 hours to complete (including study time).

Objective

The course on "Blockchain and IoT in Food Supply Chains" is designed to provide a comprehensive understanding of how Blockchain and the Internet of Things (IoT) can revolutionize the food industry. It aims to present and discuss the fundamentals of both technologies, their individual roles, and the synergy they create when integrated within food supply chains. Participants will explore the challenges and solutions involved in this integration, examining how Blockchain and IoT can enhance supply chain efficiency, reduce waste, and improve traceability. The course also includes an evaluation of real-world examples and applications in the food sector, offering insights into smart farming, efficient transportation, and food safety. Lastly, it provides potential future trends and developments in Blockchain and IoT within the food industry.

Learning Outcomes

What your trainees will learn:

- Understand the key elements, roles, and functionalities of Blockchain and IoT within the food supply chain.
- Analyse the impact of Blockchain and IoT on the security, transparency, and efficiency of supply chain operations.
- Comprehend the specific roles of IoT in data collection and Blockchain in ensuring data integrity.

- Recognize the benefits and challenges of integrating Blockchain and IoT, including technical and organizational aspects.
- Understand the economic implications, such as cost and ROI considerations, of implementing these technologies.
- Discuss emerging trends and their implications in the integration process of Blockchain and IoT.

Course Level - Education Level Required - Prerequisites

Advanced Level, Professional Development

Bachelor's Degree

Consider this course as an advanced level of "Course 1: Introduction to Blockchain Technology and Digital Assets"

Target Audience

Supply Chain Professionals, Technology Developers and Innovators, Business Executives in the Food Industry, Academics and Researchers

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes. There is one quiz for each lesson. Each quiz has 3-5 questions (i.e. multiple choice, true/false etc).

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

As a trainer preparing to guide learners through the emerging fields of Blockchain and Internet of Things, this course handbook is designed to support you in delivering an engaging and informative course. Here are some key aspects to focus on:

Introduce yourself (few words about your background and expertise)

Clarity of Learning Objectives: Begin each lesson by clearly stating the objectives. This helps trainees understand what they will learn and how it applies to their professional context.

Introductions and Expertise Sharing: Encourage participants to introduce themselves and share their background or experiences related to blockchain, finance, or the food supply chain. This fosters a sense of community and helps in identifying the collective expertise of the group.

Feedback and Positive Reinforcement: Provide constructive feedback and encouragement to motivate trainees and reinforce learning.

Humour and Relevance: Lighten the atmosphere with humour or interesting facts about blockchain and digital currencies. Relate these fun facts to real-world applications in the food supply chain to maintain relevance.

Instant Storytelling: Ask participants to share a quick story or thought about a food product, focusing on aspects like origin or traceability. This can lead to discussions about how blockchain and digital currencies could play a role.

Group Activities and Workshops: Incorporate group exercises where participants can apply concepts in hypothetical scenarios. This could include brainstorming how Blockchain and IoT could solve specific problems in the food supply chain.

Active Participation: Foster active engagement through interactive activities, group discussions, and hands-on exercises. Encourage trainees to apply what they learn to hypothetical or real scenarios.

Encourage Questions and Discussions: Create an environment where participants feel comfortable asking questions and engaging in discussions, fostering a deeper understanding of the topics.

Personalization: Adapt the training to accommodate different levels of prior knowledge and diverse learning preferences among the participants.

Visual Icebreakers: There are several visual “helpers” within the course that could help you stimulate the interest and discussions regarding blockchain and IoT. For example you could use (among others):

- The video in Lesson 1, slide 9 to provide an overview of blockchain, and the video in Lesson 1, slide 14 to present an overview about IoT.

- You could use the image in Lesson 1, slide 18 to explain the different layers of the IoT architecture.
- Showcase the diagram in Lesson2, slide 6 to present and discuss the benefits of combining blockchain with IoT.

Lesson 1: Fundamentals of Blockchain and IoT

Begin with a clear introduction to what Blockchain and IoT are, focusing on their basic principles and components. Use visual aids to explain these complex technologies in an understandable manner.

Discuss key concepts like distributed ledgers, smart contracts, and IoT architecture layers. Use slide visuals effectively to enhance understanding.

Highlight the roles of Blockchain and IoT in the food supply chain, such as waste reduction, real-time monitoring, and enhanced decision-making.

End with a summary of the key points covered, emphasizing the significance of Blockchain and IoT in transforming the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Incorporate interactive elements like group discussions or brainstorming sessions on how these technologies can transform the food supply chain.

Lesson 2: Combining Blockchain and IoT

Start by explaining the synergistic relationship between Blockchain and IoT. Use visuals to illustrate how these technologies complement each other in food supply chains.

Discuss different models of Blockchain-IoT integration, such as direct integration and middleware integration. Use the slides to detail each model and its benefits.

Analyse real-world applications and case studies showing Blockchain and IoT in action. Use engaging storytelling to bring these case studies to life.

Conclude the lesson with a summary, highlighting key points about the integration of Blockchain and IoT in supply chains.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive.

Lead a discussion on the benefits and challenges of integrating Blockchain and IoT. Use interactive elements like polls or debates to engage the audience.

Encourage group discussions or individual reflection to explore the answer.

Lesson 3: Blockchain and IoT Integration Challenges

Begin with an overview of the challenges in integrating Blockchain and IoT, focusing on technical, economic, and organizational aspects. Use the introduction slide to set the context for the lesson.

Discuss each category of challenges: technical (like interoperability and scalability), economic (high initial costs and ROI uncertainty), and organizational (change management and skill gap). Use the slides to explain each challenge in detail.

After presenting each challenge, discuss potential solutions. This could include newer blockchain architectures for scalability, strategies for ROI calculation, and approaches to change management.

Address emerging challenges such as edge computing and decentralized finance (DeFi). Discuss their implications in the integration process.

Use the provided slides to highlight these emerging trends and encourage participants to think about how these could affect future integrations.

Conclude the lesson with a summary, emphasizing the significance of understanding and addressing integration challenges for successful Blockchain and IoT deployment in the food supply chain.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Lesson 4: Case Studies & Future Developments

Start with an overview highlighting the importance of real-world examples in understanding the practical application of Blockchain and IoT in the food supply chain. Emphasize how these technologies are currently transforming the industry.

For each case study, such as smart farming or efficient transportation, go through the implementation details, outcomes, and lessons learned. Use storytelling techniques to make the cases engaging and relatable.

Encourage participants to critically analyse these cases, focusing on both successes and challenges.

Discuss emerging technologies like AI-driven blockchain analytics, IoT in autonomous vehicles, and integration with big data. Explain how these technologies might influence future food supply chain management.

Facilitate a brainstorming session on how these future trends could impact the participants' work or industry.

Conclude the lesson by summarizing the key points, emphasizing the transformative potential of blockchain and IoT in the food supply chain and the importance of staying updated with future trends.

Incorporate interactive elements like polls or questions to assess trainees' initial knowledge and expectations.

Consider grouping participants with different backgrounds and ask them to analyse different aspects of the lesson.

Formative Assessment: Engage trainees with question(s) and discussions to assess their understanding. This also keeps the session interactive

Relevant Readings

- Kumar, Shashank, et al. "Integrated blockchain and internet of things in the food supply chain: Adoption barriers." Technovation 118 (2022): 102589.
- Duan, Jiang, et al. "A content-analysis based literature review in blockchain adoption within food supply chain." International journal of environmental research and public health 17.5 (2020): 1784.
- Kumar, R. Lakshmana, et al. "A survey on blockchain for industrial internet of things." Alexandria Engineering Journal 61.8 (2022): 6001-6022.
- Malik, Nida, et al. "A comprehensive review of blockchain applications in industrial Internet of Things and supply chain systems." Applied Stochastic Models in Business and Industry 37.3 (2021): 391-412.

Additional readings can be found within each Lesson's presentation.

Course Provider / Contact Details

Comments and inquiries may be addressed to Evgenia Kapassa (kapassa.e@unic.ac.cy), University of Nicosia

Course #19: Combined Powers: Blockchain and AI in Transforming the Food Supply Chain

Content and Duration

The lessons provided with the course "Combined Powers: Blockchain and AI in Transforming the Food Supply Chain" are as follows:

Lesson 1: Introduction to Blockchain and AI

Lesson 2: Food Supply Chain Challenges

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

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

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

Approx. 3,5 hours to complete.

Objective

This course introduces us to the concepts of Artificial Intelligence and Blockchain Technology. It aims to approach AI by categorizing it and comparing it to human intelligence followed by an introduction to Blockchain Technology and smart contracts. The limits of the blockchain and the solutions of artificial intelligence are defined to highlight the importance of the blockchain - Artificial Intelligence synergy and the future direction of this synergy is being explored. Additionally, the concept of the Food Supply Chain is introduced. In order to elaborate on the supply chain processes, it is broken down into five stages: production, processing, distribution, retailing, consumption. Each stage of this chain is explained and also the challenges affecting the whole journey of the product from farm to fork are categorized into four different categories and further analysed. Furthermore, the optimized structure of the Food Supply Chain with the beneficial changes provided by the blockchain technology solutions is approached. The current

applications of Artificial Intelligence and blockchain technology in the food supply chain are discussed aiming at highlighting the beneficial impact on the whole process.

With a goal to explore the optimization of the supply chain efficiency, the combination of the future direction of artificial intelligence and blockchain technology is the main topic up next. As blockchain and AI technologies continue to evolve, we can expect to see increased adoption of their applications across the food industry, leading to a more sustainable, resilient, and trustworthy food system. The potential of these two technologies' evolution is presented through various applications in different fields, such as tokenization, decentralized marketplaces, sustainability tracking or food safety compliance. Finally, we investigate 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. Also, the results of predictive analysis and real-time decision-making with AI and blockchain are examined. Course #19 is completed with the presentation of use cases of these innovative technologies and real-world examples.

Learning Outcomes

What your trainees will learn:

- Define the fundamental concepts of artificial intelligence and blockchain.
- Recognize the limitations of the blockchain technology and understand how AI can overcome these obstacles.
- Explore the future of blockchain – AI synergy.
- Have a complete view of the Food Supply Chain/Recognise the main current problems and weak points in the Food Supply Chain.
- Get to know the processes and the people involved until a product reaches the consumer.
- Identify the key concepts behind blockchain and artificial intelligence technology and how they can be used in the food supply chain.
- Recognize the possible advantages of using blockchain innovations for food safety, transparency, and traceability.
- Determine the precise methods of AI in the food supply chain that can foster sustainability, innovation, and efficiency.
- Explore areas of application combining these innovative technologies for the optimization of the FSC.
- Explore the future of the AI – blockchain integration.
- Understand possible applications, such as:
    - Tokenization,
    - Decentralized marketplace
    - AI applications for food safety compliance and new product development

- Sustainability tracking

- Understand what an AI-driven smart contract is and explore how it benefits the supply chain processes.
- Get in touch with examples of companies using these technologies

Course Level, Education Level Required, and Prerequisites

Intermediate Level, Continuing Education

Bachelor's Degree

Trust Food course #18, Combined Powers: Blockchain and IoT in Transforming the Food Supply Chains..

Target Audience

University students, university graduates, business managers, business owners, agrifood company employees, food supply chain personnel and technology professionals/developers

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quizzes.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Follow blended learning theories (behaviorism for basic knowledge, and constructivism for problem-solving). Begin the Course by briefly providing the objective, the learning outcomes and structure (i.e., lessons).

Introduce yourself (few words about your background and expertise)

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to FSC and the applications of blockchain.

Create a concise map of expertise, skills, and experiences, that exist within your audience. This will help you to create groups for peer learning (e.g., mix IT with supply chain backgrounds) as well as to personalize the training experience.

The learning method adopted that deviates from the conventional method of just a trainer led training allows you for interaction and feedback while utilizing the material hosted on the online platform as a tool.

You are able to adapt the material to suit the individual needs of your participants and the human element present generates questions and collaboration among their peers.

By providing real-time, personalized instructions amplify the result of the learning process.

Immediate feedback and interaction with your audience will assist you in providing them a deeper understanding.

A set of methods for engagement are being explained below in order for you to be prepared. Additional to them, and to the preparation above, make sure to introduce the gamification elements through the quizzes that are included in all lessons.

Lesson 1: Introduction to Blockchain and AI

When designing the teaching methodology for an Introduction to Blockchain and AI (Lesson 1), it's crucial to consider the complexity and interdisciplinary nature of the subject matter.

Begin with foundational terms covering the basics. Introduce the term Artificial Intelligence by starting with the term intelligence. Follow up with the categorization of AI. Splitting it up into its basic components and categorizing them, participants will be more familiar with its development and solutions.

In slide 12 you can utilize the visual representation of how blockchain works to clarify this complex concept.

Make sure to foster interactive discussions to encourage critical thinking and a deeper exploration into the topic. Slide 13 presents an example transaction in Bitcoin. At this point

you are presented with an opportunity to trigger a discussion using a real-world case study that showcases the practical application of Blockchain and AI technologies.

Returning to a more theoretical pattern, present the key elements of Blockchain and also the 4 main types of Blockchain. The lesson ends with a presentation of the limitations of Blockchain and AI solutions. You can finish up the lesson with reflection sessions where the participants can synthesize their learning and identify connections between blockchain and AI concepts, highlighting the benefits of this synergy.

Lesson 2: Food Supply Chain Challenges

Lesson 2 introduces the concept of the Food Supply Chain. Provide an overview of the stages of the Food Supply Chain. Initiate a discussion of the key stakeholders that are involved such as farmers, manufacturers, distributors, retailers and consumers.

As a next step highlight the challenges of food traceability, quality control, safety regulations and sustainability. You can inquire whether the participants are aware of the challenges that the Food Supply Chain is facing prior to presenting them encouraging this way the participants to share their perspectives, ask questions and challenge assumptions in order to promote a dynamic learning environment.

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

Lesson 3 starts with a reminder of the steps of the Food Supply Chain. Encourage active participation. Ask the participants to describe the journey of food products from farm to fork. What are the stages and who are the main parties involved in this process?

Utilize then the image provided in slide 6 as a visual aid to stimulate the discussion around the Blockchain in the FSC. Showing the comparison of the products' physical with their digital journey will assist you in engaging the participants. You can further dive into the Blockchain – AI applications by presenting the exact areas of application.

Finally, you can conclude the lesson by highlighting that the synergistic integration of AI and Blockchain technologies fosters a robust, seamless, and efficient food supply chain summarizing the benefits that were mentioned.

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

Lesson 4 starts by presenting the integration of blockchain and AI which involves elucidating the synergies between these technologies and exploring their combined potential to revolutionize the Food Supply Chain. Explain the concept of integrating blockchain and AI technologies to leverage their complementary strengths.

Dive into the technical aspects of integrating Blockchain and AI, discussing methods that facilitate interoperability and collaboration between the two technologies.

Incorporating videos into your teaching methodology can enhance engagement, facilitate comprehension, and provide visual reinforcement of key concepts. In slide 12 you can integrate strategically the video provided. By reminding your participants the terms Artificial Intelligence, Blockchain, as well as the impact of Blockchain on AI and vice versa, you create a dynamic and immersive learning experience that caters to diverse learning styles and fosters a deeper engagement with the material.

You can close the lesson by presenting the potential of Blockchain and AI technologies' evolution through various applications in different fields, such as tokenization, decentralized marketplaces, sustainability tracking or food safety compliance.

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

Lesson 5 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.

Start by introducing AI-driven smart contracts and move on to the ones applied in the Food Supply Chain. Highlight their beneficial results like the fact that they provide dynamic and intelligent agreements that are adaptable and make decisions based on data and unpredictable circumstances.

Use the visual aid in slide 12 that explains the applications of IoT smart contracts in the Food Supply Chain. Explore with your participants how IoT devices and Blockchain technology can be integrated to enhance transparency, traceability and efficiency in food production, distribution and consumption.

Case studies are an effective teaching method for illustrating real-world applications of concepts and theories in a particular field and in our case Blockchain and AI application in the Food Supply Chain. Make sure to mention that there are a few notable case studies showcasing their application in the FSC and which demonstrate how we can utilize Blockchain and AI technologies to address key challenges.

What might be really interesting to present is the evolution of applications in the Food Supply Chain starting from the year 2015 ending up close to today (2022). Showing this evolution can help your participants gain a deeper understanding of how technology has transformed the industry over time.

The holistic perspective of the evolution of applications in the food supply chain will empower your participants to contribute meaningfully to its continued evolution. This will create a nice closing discussion on the future of Blockchain and AI synergy.

Relevant Readings

Abideen, A. Z. et al. (2021) “Food supply chain transformation through technology and future research directions—A systematic review,” Logistics, 5(4), p. 83. doi: 10.3390/logistics5040083

Aminetzah, D. et al. (2022) A reflection on global food security challenges amid the war in Ukraine and the early impact of climate change, Mckinsey.com. McKinsey & Company. Available at: https://www.mckinsey.com/industries/agriculture/our-insights/a-reflection-on-global-food-security-challenges-amid-the-war-in-ukraine-and-the-early-impact-of-climate-change (Accessed: February 12, 2024).

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Koufteros, X. and Lu, G. (2017) “Food supply chain safety and security: A concern of global importance,” Journal of marketing channels, 24(3–4), pp. 111–114. doi: 10.1080/1046669x.2017.1393227

Kumar, M. (2023) AI-driven smart contracts: Merging intelligence with automation, Oodles Blockchain. Available at: https://blockchain.oodles.io/blog/ai-driven-smart-contracts/ (Accessed: February 12, 2024).

Leung, H., Chapman, A. and Fadhel, N. (2021) “Identifying Food Fraud using Blockchain,” in Proceedings of the 6th International Conference on Internet of Things, Big Data and Security. SCITEPRESS - Science and Technology Publications

Lewis, M. (2023) Blockchain + AI: A surprising sustainability solution, The Futurum Group. Available at: https://futurumgroup.com/insights/blockchain-ai-a-surprising-sustainability-solution/ (Accessed: February 12, 2024)

Marwala, T., & Xing, B. (2018). Blockchain and Artificial Intelligence. ArXiv. /abs/1802.04451

McCarthy, J. (2012). What is AI? / Basic Questions. Retrieved from http://jmc.stanford.edu/artificial-intelligence/what-is-ai/index.html

Moshy, C. (2023) Combining AI & blockchain data for predictive analysis, fraud prevention, and more, Snowflake. Available at: https://medium.com/snowflake/combining-ai-blockchain-data-for-predictive-analysis-fraud-prevention-and-more-2b720e5d27e7 (Accessed: February 12, 2024).

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Course Provider / Contact Details

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Course #20: Roadmap for the Use of Blockchain Technologies in the Food Supply Chain

Content and Duration

The lessons provided with the course “Roadmap for the Use of Blockchain Technologies in the Food Supply Chain” are as follows:

Lesson 1: Introduction to the fundamentals of blockchain technology

Lesson 2: Introduction to the food supply chain ecosystem

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

Lesson 4: Private vs. public blockchains

Lesson 5: Real-world examples of successful blockchain implementations

Lesson 6: Assessing the readiness and feasibility of blockchain adoption

Lesson 7: Protecting sensitive data on the blockchain

Lesson 8: Fair trade, sustainability, and responsible sourcing

Approx. 5 hours to complete.

Objective

The overarching aim of the "Roadmap for the Use of Blockchain Technologies in the Food Supply Chain" course 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 catalyze 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.

Learning Outcomes

What your trainees will learn:

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.

Course Level, Education Level Required, and Prerequisites

Beginners, Professional Development or Continuing Education

High School Diploma or Equivalent

Supply chain basics, Trust Food course #10 and #1, basic understanding of certification processes, background in agriculture and/or food science

Target Audience

University students, university graduates, agrifood company employees and food supply chain personnel

Assessment - Certification of Attendance - Badges

The assessment for this course is realized with the corresponding quiz that is comprised of 32 multiple choice and true-false questions.

A certificate of attendance will be provided upon completion of all lessons and quizzes.

Guidelines for the Trainer

Introduce yourself (few words about your background and expertise)

Introductions & Expertise Mapping: Have participants introduce themselves and share their expertise, skills, and experiences relevant to FSC and the applications of blockchain.

Create a concise map of expertise, skills, and experiences, that exist within your audience. This will help you to create groups for peer learning (e.g., mix IT with supply chain backgrounds) as well as to personalize the training experience.

What is blockchain technology?

What are the key components of blockchain technology?

What are the some of the applications of blockchain technology?

Lesson 1: Introduction to the fundamentals of blockchain technology

This lesson will explore the basics of blockchain technology, starting with its basic principles of operation, through an overview of key terms and concepts, all the way to practical applications in the real world.

Blockchain technology, designed through the concept of decentralization and a distributed ledger of transactions, is revolutionizing the way information is stored, protected and

exchanged in the digital environment. This technology has become the basis for the development of many applications, especially in areas such as finance, logistics, healthcare, and many others.

After the theoretical part, organize an interactive discussion with the students about the key concepts and terminology related to blockchain. This includes terms like blocks, hash functions, smart contracts, cryptocurrencies and other relevant terms.

Present real-world examples to illustrate practical applications of blockchain technology. These may include examples of blockchain usage in the financial sector, supply chain, healthcare, real estate and other areas.

Encourage students to participate in a workshop on creating a blockchain transaction. The intern can use simulators or development tools that allow students to create their own transaction, see how blocks are connected, and understand the process of validating and confirming transactions.

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At the end of the lesson, organize a final discussion about the future of blockchain. The intern can ask questions about the potential challenges, innovations and trends shaping the future of this technology, encouraging students to think about how blockchain could affect different industries and social processes.

Lesson 2: Introduction to the food supply chain ecosystem

This lesson will take you on a journey through the intricate network that sustains the global food industry, from production to consumption. We'll explore key concepts, processes, and challenges within the food supply chain, shedding light on its complexities and opportunities

Encourage the intern to create an interactive mind map presentation that will visually depict key concepts, processes and challenges within the food supply chain.

Assign an intern the task of researching and analyzing various case studies within the food supply chain.

Take a virtual tour through the different stages of the food supply chain, including production, distribution, storage and sales. The intern can use a variety of multimedia resources, such as videos, images, and interactive maps, to provide students with insight into each stage of the food supply chain.

Assign an intern to create an infographic that will show the complexity of the food supply chain and the challenges that stakeholders face.

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Invite food supply chain experts to participate in a panel discussion with students. The intern can moderate the discussion by asking questions of experts about key concepts, challenges and trends within the food supply chain.

Ask questions that encourage deeper thinking about the topic, such as "What are the key components of the food supply chain ecosystem?" or "How does the food supply chain affect the global economy and environment?"

Assign students an assignment for further research on a particular aspect of the food supply chain that is of particular interest to them or that was not covered in depth during the lesson. This encourages them to independently research the topic and expand their knowledge.

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

In this lesson, we'll explore how blockchain addresses challenges such as food fraud, safety concerns, and supply chain inefficiencies. Through real-time traceability, authentication of food products, and promoting sustainability, blockchain ensures food safety, quality, and regulatory compliance.

By the end, you'll understand how blockchain is revolutionizing the food industry and driving positive change for all stakeholders involved.

Assign the intern the task of researching and analyzing various case studies that demonstrate the application of blockchain in the food industry. Focus on cases that demonstrate how blockchain solves challenges such as food fraud, security issues and supply chain inefficiencies.

Encourage the intern to create an interactive presentation that will use real-world examples to illustrate how blockchain ensures safety, quality and regulatory compliance in the food industry. The intern can use multimedia tools such as videos, graphs and diagrams to show students various blockchain applications.

Organize a panel discussion with experts from the food industry and blockchain technology. The intern can moderate the discussion by asking experts questions about the

benefits and challenges of using blockchain in the food industry and expected future trends.

Organize a workshop on the implementation of blockchain in the food industry, where students will have the opportunity to develop concrete strategies and plans for integrating blockchain technology into their business. An intern can lead a workshop providing guidance and advice on best practices for blockchain implementation.

Encourage students to express their understanding of key concepts covered in class. This may include an explanation of how blockchain works, its benefits in the food supply chain, as well as specific industry applications.

Encourage students to think about possible future applications of blockchain technology in the food supply chain. This discussion may include predictions about how the technology will develop and how it may affect the industry in the coming years.

Lesson 4: Private vs. public blockchains

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.

Encourage the trainee to use diagrams, tables and graphs to clearly show the differences between these two types of blockchains.

Assign the intern the task of researching and analyzing various case studies that demonstrate the application of private and public blockchains in practice. The intern can show real-world examples to help students better understand how these two types of blockchains are used in different industry sectors and situations.

Organize a workshop on developing a blockchain implementation strategy, where students will develop concrete plans for implementing private or public blockchains in a specific use case. The intern can lead a workshop providing guidance and advice on how to choose the right type of blockchain based on specific project requirements.

Encourage students to write an essay on the future of private and public blockchains, exploring their applicability in different sectors and trends in technology development.

Finally, conclude the lesson by reminding students of the importance of understanding the differences between private and public blockchains and how this may affect their future career or research. Encourage them to stay informed about the progress of blockchain technology and think of ways they can contribute to its development.

Lesson 5: Real-world examples of successful blockchain implementations

In this lesson, we will explore how blockchain technology has been applied in various industries to solve real-world problems and achieve significant outcomes. Through examining case studies and success stories, we'll gain insights into the diverse applications of blockchain beyond cryptocurrency.

Assign the intern the task of researching and analyzing various case studies that showcase successful blockchain implementations in various industries. The intern can explore examples from the finance, healthcare, logistics, energy and other sectors to provide students with diverse insight into blockchain applications.

Encourage the intern to create an interactive presentation that will use blockchain implementation success stories to illustrate the variety of applications for the technology outside of cryptocurrencies.

Host a panel discussion with guests from various industries who have been involved in successful blockchain implementations. The intern can moderate the discussion by asking guests questions about their experiences, challenges and results of blockchain implementation.

Organize a debate between students about the future of blockchain and its role in transforming various industries. The intern can ask questions about the potential benefits, challenges and risks that may arise with the further expansion of blockchain technology.

Conclude the lecture by reminding students of the importance of understanding real-world examples of successful blockchain implementations and how this can shape their future career or research. Encourage them to stay informed about the progress of technology and think about ways in which they can contribute to its further development and application.

Lesson 6: Assessing the readiness and feasibility of blockchain adoption

In this session, we will delve into the crucial step of evaluating how prepared and practical it is to implement blockchain technology within your specific food supply chain. We will define various factors influencing both readiness and feasibility, equipping you with the knowledge to make informed decisions regarding this transformative technology.

Assign an intern to research the various factors that influence organizations' readiness to adopt blockchain in the food supply chain. These may include technical capacity, regulatory conditions, financial resources, strategic objectives and stakeholder acceptance of the technology.

Assign an intern the task of analyzing the costs and benefits of blockchain adoption in the food supply chain. The intern can explore the costs of implementation, the expected benefits in terms of increased efficiency, reduced waste, improved transparency, and other factors that could influence decision-making.

Assign an intern the task of writing a report on the feasibility of blockchain adoption in the food supply chain. The report should contain a detailed analysis of all relevant readiness and feasibility factors and recommendations for further steps and implementation strategies. The intern may use a variety of sources of information, including research, stakeholder interviews, and case study analysis.

Encourage students to express their understanding of the key criteria and factors to consider when assessing the readiness and feasibility of blockchain adoption. This may include technical, business, regulatory, security and other relevant aspects.

Lesson 7: Protecting sensitive data on the blockchain

While blockchain offers remarkable advantages in terms of transparency and traceability, safeguarding sensitive information requires thoughtful consideration. We will explore various strategies and best practices to ensure the security of your data on the blockchain, fostering trust and minimizing potential risks.

Assign an intern the task of researching and analyzing different types of threats and risks related to blockchain data security. The intern can investigate potential attacks such as DDoS, identity theft, 51% attack and other threats and identify strategies to protect against them.

Host a panel discussion with guests who are experts in data security and blockchain technology. The intern can moderate the discussion by asking experts questions about the latest trends, technological innovations and best practices for protecting sensitive data on the blockchain.

Assign the intern the task of analyzing compliance requirements related to the protection of sensitive data on the blockchain. The intern can research relevant regulations and standards such as GDPR, HIPAA and other legal regulations and identify the steps organizations need to take to comply with these requirements.

Consider issues of data privacy, right to be forgotten, access to data and regulatory guidelines.

Conclude the lecture by reminding students of the importance of protecting sensitive data on the blockchain and how it can affect user trust, system security, and project success. Encourage them to stay informed about the latest security trends and practices and to actively contribute to protecting data in the future.

Lesson 8: Fair trade, sustainability, and responsible sourcing

We'll explore how blockchain can be harnessed to support fair trade practices, promote sustainability, and encourage responsible sourcing throughout the food system. By integrating these values into your blockchain strategy, you can contribute to a more just, sustainable, and transparent food supply chain for all stakeholders.

This lesson will include a blend of interactive activities, informative lectures and case studies. You will gain practical insights and knowledge into how ethical considerations can be embedded into your blockchain implementation, enhancing its potential to create a more responsible and sustainable food system.

Assign an intern the task of researching the current state of fair trade practices, sustainability and responsible sourcing in the food system. The intern can research existing initiatives, certifications, and regulations and identify current challenges and gaps in implementation.

Organize a debate between students about the future of fair trade, sustainability and responsible procurement with the application of blockchain technology. The intern can ask questions about potential benefits, challenges and risks and discuss possible directions for development and innovation in this area.

Encourage students to think about the future of fair trade, sustainability and responsible sourcing and how these concepts can be further developed and implemented in different industries. Discuss the innovations, trends and opportunities that may arise in the future.

Relevant Readings

Reports and White Papers:

"Blockchain: A Game-Changer in the Food Supply Chain" by World Economic Forum

"Blockchain in the Food Industry" by Deloitte

"Blockchain: Opportunities for Fresh Food Supply Chains" by IBM Institute for Business Value

"Digitizing Trust: Blockchain for Supply Chain" by BCG and VeChain

Books:

"Blockchain Basics: A Non-Technical Introduction in 25 Steps" by Daniel Drescher

"Blockchain Revolution: How the Technology Behind Bitcoin and Other Cryptocurrencies Is Changing the World" by Don Tapscott and Alex Tapscott

"Supply Chain Management and Blockchain Technology: The Case of the Food Industry" by Angelika Langer and Christiana Köhler-Schute

Academic Articles:

"Blockchain and the Supply Chain: Concepts, Challenges, and Empirical Evidence" by L.M. Seebacher, S. Schüritz, and P. Maier

"Blockchain for Global Supply Chain: An Empirical Study" by F. Li, et al.

"Blockchain and Supply Chain Management: A Systematic Literature Review" by H. Lu, et al.

"Blockchain Adoption Challenges in Supply Chain Management" by S. Sharma, et al.

Journals and Magazines:

Blockchain in Supply Chain Today (https://www.blockchaininsupplychain.com/)

Supply Chain Management Review (https://www.scmr.com/)

Harvard Business Review (https://hbr.org/)

Empowering women through blockchain: Unlocking opportunities and driving innovation (https://guardian.ng/slide/empowering-women-through-blockchain-unlocking-opportunities-and-driving-innovation/)

Online Resources:

Blockchain Technology and the Food Supply Chain (https://www.foodchainadvisors.org/blockchain-in-the-food-industry/)

Food Safety and Blockchain (https://www.foodsafetymagazine.com/magazine-archive1/junejuly-2018/blockchain-technology-for-food-supply-chain-transparency/)

Course Provider / Contact Details

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The content in this handbook has been developed as part of the TRUSTFOOD project, which has received funding from the European Union's Digital Europe Programme under Grant Agreement No. 101100804.