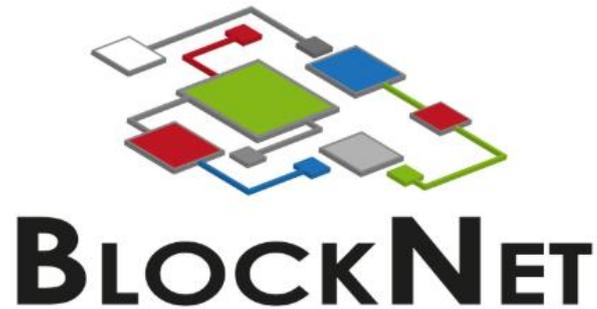


A Guide to BlockNet courses



“Blockchain Network Online Education for
interdisciplinary European Competence Transfer”
(BlockNet)

Content

| | |
|---|-----------|
| <i>About the BlockNet Project</i> | 3 |
| <i>About BlockNet Courses</i> | 4 |
| <i>BlockNet Course Structure</i> | 5 |
| <i>How to Use BlockNet Courses</i> | 6 |
| 1. <i>Introduction in Blockchain Application (5 ECTS)</i> | 8 |
| 1b. <i>Introduction in Blockchain-Enabled Business Processes (1 ECTS)</i> | 9 |
| 1c. <i>Introduction in Blockchain And Applications Development (1 ECTS)</i> | 10 |
| 2. <i>Blockchain Foundations and Development (2 ECTS)</i> | 11 |
| 3. <i>Blockchain For Logistics and Supply Chain Management (2 ECTS)</i> | 12 |
| 4. <i>Blockchain For Enterprise It Security (2 ECTS)</i> | 14 |
| 5. <i>Blockchain For Business (2 ECTS)</i> | 16 |
| <i>Contact Information</i> | 17 |

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About the BlockNet Project

Project BlockNet (“BlockChain Network Online Education for interdisciplinary European Competence Transfer”) is funded by the European Commission in the context of the Erasmus+ program “KA2-Cooperation for Innovation and the Exchange of Good Practices. Strategic Partnerships for higher education”.

The fundamental goal of Project BlockNet is the development and practical implementation of an **interdisciplinary blockchain technology** small network **online course**.

During the **Project BlockNet** 7 courses were developed for students to actively learn about blockchain technology. Project BlockNet really encompasses interdisciplinarity by focusing on blockchain technologies from various perspectives:

1. Computer Science (specialty of **University of Copenhagen**)
2. Enterprise Security (specialty of **University of Tartu**)
3. Supply Chain Management (specialty of **Technische Universität Dortmund**)
4. Business (specialty of **Vilnius University**)

Project Partners:



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More Information about the BlockNet Project: <http://project-blocknet.eu>

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About BlockNet Courses

The course modules have been prepared for you to get profound knowledge on the cutting-edge **Blockchain technology**, its development, working and security principles, and its application in the modern business environment.

About the BlockNet courses:

- ✓ 7 interdisciplinary courses
- ✓ 15 ECTS credits
- ✓ Over 1500 slides
- ✓ Over 16 hours of lecturers' narration
- ✓ Over 10 hours of video materials
- ✓ Quizzes
- ✓ Case studies

BlockNet courses are made **4 topics**: IT security, Business, Supply Chain Management, and Computer Science.

BlockNet courses are divided into 2 levels:

- 1) **Basics:**
 - ✓ 1. Introduction in Blockchain Application (5 ECTS)
 - ✓ 1b. Introduction in Blockchain-Enabled Business Processes (1 ECTS)
 - ✓ 1c. Introduction in Blockchain And Applications Development (1 ECTS)
- 2) **Advanced:**
 - ✓ 2. Blockchain Foundations and Development (2 ECTS)
 - ✓ 3. Blockchain For Logistics and Supply Chain Management (2 ECTS)
 - ✓ 4. Blockchain For Enterprise It Security (2 ECTS)
 - ✓ 5. Blockchain For Business (2 ECTS)

If You are interested to know how the BlockNet course concept was created please read [Exploring the Blockchain Skills Concept and Best Practice Use Cases](#) and [Curriculum Guidance Document](#).

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BlockNet Course Structure

BlockChain Network Online Education for Interdisciplinary European Competence Transfer

| BCT-BASICS | | IT-SECURITY | BUSINESS | SUPPLY CHAIN MANAGEMENT | COMPUTER SCIENCE |
|---|---|--|--|---|------------------|
| 1. BLOCKCHAIN (5+1+1 ECTS) | 4. BLOCKCHAIN FOR ENTERPRISE IT SECURITY (2 ECTS) | 5. BLOCKCHAIN FOR BUSINESS (2 ECST) | 3. BLOCKCHAIN FOR LOGISTICS & SUPPLY CHAIN MANAGEMENT (2 ECTS) | 2. BLOCKCHAIN FOUNDATIONS & DEVELOPMENT (2 ECTS) | |
| 5 ECTS | 1 ECTS | 1 ECTS | 1 ECTS | 1 ECTS | |
| INTRODUCTION IN BLOCKCHAIN APPLICATION (5 ECTS) 1. Introduction to distributed ledger technologies and properties (2h) 2. Business development (1h) 3. Digital entrepreneurship (30 min) 4. Introduction to cryptography (2h) 5. Introduction to information systems for blockchain and challenges (2h) 6. Business processes (2h) 7. Business requirement & specification (2h) 8. Blockchain-enabled supply chain processes (4h) 9. Cryptocurrencies (2h) 10. Tokenization (1h) 11. Token-based exchange mechanisms (1h) | 1. Security design for distributed information systems (2h) 2. Cryptographical methods (2h) 3. Blockchain components and security methods (2h) 4. Secure platforms, tools and Enterprise models (2h) | 1. Business activities & processes (2h) 1. Innovation management using information systems (2h) 3. Blockchain components and security methods (2h) 4. Blockchain business transformation (1h) 5. Blockchain-enabled business processes (1h) | 1. Supply chain management and processes (2h) 2. Information Systems in SCM and Blockchain Framework (2h) 3. Blockchain Use Cases and Projects (2h) 4. Business Value of Blockchain Solutions (2 h) | 1. Introduction to cryptography (2h) 2. Introduction to distributed computing (1 h) 3. Introduction to information systems (1h) 4. Blockchain components and systems development (1h) 5. Blockchain platforms (1h) 6. Blockchain programming models (2h) | |
| 1 ECTS | | | | | |
| 1b INTRODUCTION IN BLOCKCHAIN-ENABLED BUSINESS PROCESSES 1. Blockchain for various industries (4h) | | | | | |
| 1 ECTS | | | | | |
| 1c INTRODUCTION IN BLOCKCHAIN AND APPLICATIONS DEVELOPMENT 1. Introduction to platform and application development (1h) 2. Programming models (1h) 3. Smart contract programming (2h) | | | | | |



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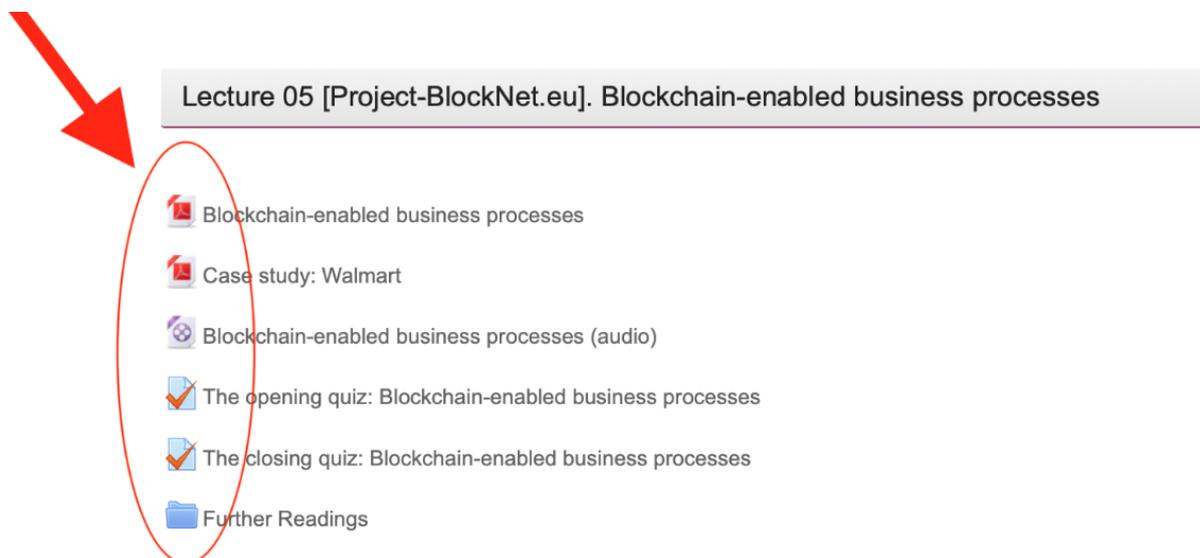
How to Use BlockNet Courses

BlockNet courses have different **ECTS credits** ([more about the ECTS system](#)).

In BlockNet courses 1 ECTS requires between 25 to 30 hours of work from a student, the lecture recordings are supplemented by reading materials, videos, podcasts, and quizzes to create a meaningful workload in accordance with the study goals and requirements.

Lecture structure:

- ✓ Lecture slides (PDF)
- ✓ Lecture voice-over recording (lecturer's narration for the lecture slides)
- ✓ Additional video and audio materials
- ✓ The opening quiz
- ✓ The closing quiz



It is a good idea to start with the **lecture slides** in PDF format, get yourself familiar with the module's Learning Goals, which are always stated in one of the first lecture slides in each module, and with the overall structure of the module.

Next follow the **voice-over lecture** recording to listen to either the whole lecture or only the specific parts of it to suit your personal interests and needs. Follow the instructions for mandatory assignments and readings. Finally, see the Further Reading folder for complementary literature.

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Some lectures have **opening quizzes**. Opening quizzes should be completed before the lecture. We know that You might not possess the right knowledge at this moment, but the purpose of opening quiz is to show the theme of the lecture and to inspire You to learn why Your answers were right or wrong during the lecture.

All BlockNet lectures have **closing quizzes**. The purpose of closing quiz is to measure the knowledge and learning progress.

In the next part You will find a brief description of all BlockNet courses in recommended order:

1. Introduction in Blockchain Application (5 ECTS)
- 1b. Introduction in Blockchain-Enabled Business Processes (1 ECTS)
- 1c. Introduction in Blockchain And Applications Development (1 ECTS)
2. Blockchain Foundations and Development (2 ECTS)
3. Blockchain For Logistics and Supply Chain Management (2 ECTS)
4. Blockchain For Enterprise It Security (2 ECTS)
5. Blockchain For Business (2 ECTS)

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1. Introduction in Blockchain Application (5 ECTS)

Blockchain has the potential to disrupt multiple industries by making transactions and processes more democratic, secure, transparent, and efficient. Building on this vision, You will explore how the capabilities and the underlying mechanism of blockchain can be applied to generate economic and social value. This course highlights the central topics of blockchain and distributed ledger technologies. It is designed to familiarize you with the foundations of blockchain technology and its key application areas. Practical case studies are presented by external industry stakeholders.

Intended learning outcomes:

By the end of the course, You should be able to:

1. Identify and explain the foundations, architecture, concepts, principles, and technologies that were presented in the course, including their key terminology, underlying assumptions, and how they relate to one another.
2. Compare the principal characteristics of blockchain platforms.
3. Demonstrate how the theories, concepts, and Blockchain technologies that were presented in the course were applied in the different topics of IT security, Business, Supply Chain Management, and Computer Science.

Course plan:

1. Introduction to distributed ledger technologies and properties (2h)
2. Business development (1h)
3. Digital entrepreneurship (30min)
4. Introduction to cryptography (2h)
5. Introduction to information systems for blockchain and challenges (2h)
6. Business processes (2h)
7. Business requirement and specification (2h)
8. Blockchain-enabled supply chain processes (4h)
9. Cryptocurrencies (2h)
10. Tokenization (1h)
11. Token-based exchange mechanisms (1h)

Student workload:

| Task | Total hours |
|---------------------------|-------------|
| Lectures | 17.5 |
| Audio and video materials | 7.5 |
| Case studies | 20 |
| Further Readings | 90 |
| Total | 135 |

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1b. Introduction in Blockchain-Enabled Business Processes (1 ECTS)

Why are many businesses planning to adopt blockchain technologies, and why do so many people claim it will revolutionize the world? Blockchain technology is arguably one of the most promising and most hyped innovations of recent years. Blockchain technology is beginning to challenge practices in various business sectors. So, in this course You will explore the opportunities for blockchain technology in various industries.

Intended learning outcomes:

By the end of the course, You should be able to:

1. Identify opportunities, needs and challenges for blockchain technologies in various industries:
 - ✓ Finance industry
 - ✓ Manufacturing
 - ✓ Energy industry
 - ✓ Healthcare industry
 - ✓ Government and public sector
 - ✓ Retail
 - ✓ Creative industries
2. Recognize regulatory uncertainty challenge for the adoption of blockchain technologies.

Course plan:

1. Blockchain for various industries (4h)

Student workload:

| Task | Total hours |
|---------------------------|-------------|
| Lectures | 4 |
| Audio and video materials | 1 |
| Case studies | 7 |
| Further Readings | 16 |
| Total | 28 |

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1c. Introduction in Blockchain And Applications Development (1 ECTS)

Blockchain is considered to be one of the most promising technologies, so it has aroused the enthusiasm for learning it all over the world. However, since blockchain spans multiple disciplines such as computer science, cryptography, and economics, beginners who want to learn and apply blockchain technology are often at a loss. In this course, we will introduce the basic knowledge of blockchain and simple smart contract development to help novices quickly get started with blockchain.

Intended learning outcomes:

By the end of the course, you should be able to:

1. Grasp the basic concepts of blockchain and be familiar with representative blockchain platforms, including public and private chains.
2. Understand the basic model and application development process of blockchain.
3. Understand blockchain data structure, transaction structure, and typical consensus algorithms.
4. Explain what a smart contract is and what it differs from a legal contract.
5. Learn Ethereum blockchain platform and how it works.
6. Learn how to apply the basic modelling standards to a blockchain-oriented software.

Course plan:

1. Introduction to platform and application development (1h)
2. Programming models (1h)
3. Smart contract programming (2h)

Student workload:

| Task | Total hours |
|------------------------------|-------------|
| Class lectures and exercises | 4 |
| Audio and video materials | 4 |
| Case studies | 9.5 |
| Further Readings | 10.5 |
| Total | 28 |

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2. Blockchain Foundations and Development (2 ECTS)

Blockchain is widely known as a distributed ledger technology with many salient characteristics such as decentralization, tamper-resistance, and traceability. These advantages have fostered a large number of blockchain platforms and decentralized applications (DAPP) beyond cryptocurrencies. Why does blockchain have such attracting features and application promise? What are the underlying supporting techniques? What are the overall architecture and basic components of blockchain? How does it work and what are the trending blockchain platforms? How can we develop a DAPP for practical need? In this course, we will explore blockchain foundations, including the major cryptographic techniques, distributed systems, information systems, and its basic components. We then present several representative blockchain platforms and compare them from a multi-dimensional perspective. Finally, we introduce the blockchain programming models with a specific focus on smart contract design on the Ethereum blockchain. Several application examples are provided for ease of understanding.

Intended learning outcomes:

By the end of the course, you should be able to:

1. Understand and explain the cryptographic technique used in blockchain, CAP theorem and the trade-off among properties in distributed system, blockchain data structure, consensus algorithms, and basic work principle.
2. Identify public, private, and consortium blockchain platforms, their differences in governance, access, security, cost..., learn how to choose a blockchain platform for your application development.
3. Apply the basic modelling standards to develop smart contracts on the Ethereum blockchain according to the application needs.

Course plan:

1. Introduction to cryptography (2h)
2. Introduction to distributed computing (1h)
3. Introduction to information systems (1h)
4. Blockchain components and systems development (1h)
5. Blockchain platforms (1h)
6. Blockchain programming models (2h)

Student workload:

| Task | Total hours |
|------------------------------|-------------|
| Class lectures and exercises | 8 |
| Audio and video materials | 6.5 |
| Case studies | 10 |
| Further Readings | 30 |
| Total | 54.5 |

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3. Blockchain For Logistics and Supply Chain Management (2 ECTS)

Building up on the supply chain introductory module “Introduction to Blockchain-Enabled Supply Chain Processes”, where first definitions and basics are conveyed, the advanced section “Blockchain for Logistics and Supply Chain Management is composed of another four modules.

3.1 Supply Chain Management and -Processes

The first advanced module “Supply Chain Management and –Processes” gives a focus on the historical development of logistics and supply chain management and explains important trends, like globalization, digitalization and others. The supply chain management tasks from the basic module are reflected here one more time and equipped with more details. The module concludes with explanations on important supply chain processes.

3.2 Blockchain Frameworks in Supply Chain Management

The second advanced module makes blockchain frameworks a subject of discussion. Those frameworks and consensus mechanisms that are utilized for supply chain management are given priority here. The module concludes with challenges and opportunities for blockchain in supply chain management

3.3 Blockchain Projects in Supply Chain Management

The third advanced module deals with blockchain use case that are most relevant for supply chain management and delivers an overview. Also the set-up of blockchain projects and their involved parties are explained in this module. The module concludes with explanations on interdisciplinarity, that plays a key role in blockchain space.

3.4 Blockchain Integration and Business Value

The fourth and last advanced module discusses the status of current blockchain projects and shows ways how blockchain solutions could be integrated systematically. In this context all relevant steps from the pre-evaluation to the processes analysis and the development of a blockchain-based concept are explained. The module concludes with topics around the business value of blockchain solutions and their profitability.

Intended learning outcomes:

By the end of the course, You should be able to:

1. Understand the main tasks and goals of SCM
2. Understand the implications of globalization, digitalization and other trends that affect SCM and identify relevant pain points
3. Understand the implications of blockchain technology in and for SCM and have knowledge about different use cases and why they are initiated
4. Explain supply chain processes and corresponding challenges
5. Explain different types of blockchains and understand which ones can be utilized for SCM
6. Understand the key components and involved parties of blockchain projects and how they are set up
7. Explain different disciplines and enterprise functions involved in blockchain projects
8. Understand the opportunities and challenges blockchain projects are facing

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9. Be able to identify and explain steps needed for a blockchain integration in business processes

Course plan:

1. Supply chain management and processes (2h)
2. Information Systems in SCM and Blockchain Frameworks (2h)
3. Blockchain Use Cases and Projects (2h)
4. Business Value of Blockchain Solutions (2h)

Student workload:

| Task | Total hours |
|------------------------------|-------------|
| Class lectures and exercises | 8 |
| Preparation of classes | 12 |
| Follow-up on classes | 12 |
| Exam preparation | 20 |
| Total | 52 |

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4. Blockchain For Enterprise IT Security (2 ECTS)

4.1 Security design for distributed information systems

In the first part of this course, the definitions of the blockchain and security are provided. We discuss the principles of blockchain security and overview the role cryptography. The lecture finishes with the overview of blockchain applications and platforms.

4.2 Cryptographic methods in blockchains

In the second lecture of this course, we overview, analyze, and compare cryptographic principles, identity management, access control, and privacy principles used in three blockchain platforms – Bitcoin, Ethereum, and Hyperledger Fabric.

4.3 Blockchain components and security methods

In the third lecture of this course, we discuss security risks and their countermeasures. Firstly, it is considered what security risks can be mitigated using the blockchain technology. Secondly, we discuss what are security risks that appear in the blockchain based applications.

4.4 Secure platforms, tools, and enterprise models

In the fourth lecture of this course, we consider a case study. The goal of this lecture is to perform a hands-on exercise and design the dApps in the different blockchain platforms.

Intended learning outcomes:

By the end of the course, You should be able to:

1. Identify and explain the foundational theories, concepts, and technologies used in the cryptographic methods in Blockchains. This includes to:
 - ✓ Recognise security countermeasure implications
 - ✓ Explain how the use of the Blockchain technology can secure data, information and processes
 - ✓ Underline significant encryption and signature schemes
 - ✓ Describe transaction protection and validation principles
 - ✓ Explain identity management principles using the Blockchain solutions
 - ✓ Explain access control models
 - ✓ Describe privacy management principles using the Blockchain solutions
2. Exhibit the ability to apply blockchain technology through assessable model fragments.
3. Reflect on systems design and foundational or security challenges.

Course plan:

1. Security design for distributed information systems (2h)
2. Cryptographic methods in blockchains (2h)
3. Blockchain components and security methods (2h)
4. Secure platforms, tools, and enterprise models (2h)

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Student workload:

| Task | Total hours |
|------------------------------|-------------|
| Class lectures and exercises | 8 |
| Audio and video material | 8 |
| Case studies | 15 |
| Further reading | 14 |
| Preparation for exam | 7 |
| Total | 52 |

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5. Blockchain For Business (2 ECTS)

Blockchain technology has gained widespread traction and is attracting investments like no other emerging technology. A growing number of use cases are being discussed, tested, and implemented across a range of industries. In this course You will explore blockchain potential form business management perspective.

Intended learning outcomes:

By the end of the course, You should be able to:

1. Identify and explain the foundational theories, concepts, and technologies that were presented in the course, including their key terminology, underlying assumptions, and how they relate to one another.
2. Identify the opportunities for blockchain application in supporting the goals of business process optimization.
3. Explain the role of blockchain in enabling business development and innovation.
4. Discuss what specific opportunities for business transformation can be enabled by blockchain.

Course plan:

1. Business activities & processes (2h)
2. Innovation management using information systems (2h)
3. Blockchain components and security methods (2h)
4. Blockchain business transformation (1h)
5. Blockchain-enabled business processes (1h)

Student workload:

| Task | Total hours |
|---------------------------|-------------|
| Lectures | 8 |
| Audio and video materials | 4 |
| Case studies | 6 |
| Further Readings | 36 |
| Total | 54 |

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