



# AuToMa

AUTOMATION, TECHNOLOGY TRANSFER AND  
MANAGERIAL PRACTICES FOR THE GROWTH  
OF SMES, A BETTER EMPLOYABILITY AND THE  
PROMOTION OF THE ENTREPRENEURSHIP

[www.automata-project.eu](http://www.automata-project.eu)



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## IO5: Handbook for AuToMa learners

<b>Project Title</b>	<b>“Automation, Technology transfer and Managerial practices for the growth of SMEs, a better employability and the promotion of the entrepreneurship”</b>
<b>Project Acronym</b>	<b>AuToMa</b>
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## Annex 1: Overview of AuToMa modules by learning path

### TECHNICAL LEARNING PATH

#### Module 1: ICT based means for automation and innovation

##### Module overview and training content explained

<b>Module purpose and learning objectives</b>	<p>The main purpose of this module is to understand the application of the information and communication technologies (ICT) as a decisive factor for the raising of productivity and the economic growth, observed in many industrialized countries. Higher competitiveness, lower costs and access to new markets are expected with the deployment of ICT on a company level. In this module, an analysis of the deployment of automation and innovations is made and their effect to the small and medium enterprises (SME) is examined. In addition, in this module the main obstacles to SMEs in respect to the realization of their innovation potential and their ability to create work places are analysed. The module can be used in programs for enhancing the qualification and re-qualification of the workers in SMEs.</p> <p>As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following <b>learning outcomes</b>:</p> <p><b>Knowledge:</b> raised awareness of the role of innovation on the business process; understanding the role of a learning organization; define the role of the enablers; improved understanding of the concept of automation; describe the impact of an efficient management of innovation</p> <p><b>Skills:</b> improved ability to describe the impact of an efficient management of innovation; removing the obstacles on ICT usage; verify how structure and staff can obtain advantages by industrial automation; improved ability to identify impetuses and obstacles related to ICT for raising the productivity in the organization; improved ability to adapt traditional methods, concepts, models to new applications;</p> <p><b>Competences:</b> learning organization; facilitating a climate that supports ICT in an organization; leader behaviors; analytical thinking.</p>
<b>Time schedule</b>	<p><b>Module total workload:</b> 1 hour and 10 minutes including:</p> <ul style="list-style-type: none"><li>• <i>Time for reading training content:</i> 40 minutes</li><li>• <i>Time for interactive learning (discussions, exercises, case studies, etc.):</i> 25 minutes</li><li>• <i>Time for test questions:</i> 5 minutes</li></ul>
<b>Training module</b>	<p><b>Learning content:</b> the module is divided into three lessons:</p> <ol style="list-style-type: none"><li>1) Innovation processes and impact measuring – the application of the information</li></ol>



## structure

and communication technologies (ICT) as a decisive factor for the raising of productivity and the economic growth is presented:

- 1.1. Innovation processes and success measuring
- 1.2. Strategic management of innovation
- 1.3. Creating a learning organisation
- 1.4. Organizational structure and human resources of firms that make use of industrial automation
- 1.5. Technological complexity

2) Obstacles and enablers of ICT usage Lesson - presents the added value of ICT adoption and the needed processes adaptation, obstacles and limits of ICT usage are also described and an analysis of the needed key indicators of innovation and technology transfer is identified.

- 2.1. Obstacles and enablers of ICT usage
- 2.2. Automation

3) Key indicators of innovation and technology transfer - an analysis of the deployment of automation and innovations is made and their effect to the SMEs is examined:

- 3.1. Innovation and technology transfer
- 3.2. Literature review and research design
- 3.3. Areas of innovation in SME
- 3.4. Expenditure on R&D in percent of turnover in SME
- 3.5. Research cooperation of SME

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the importance of ICT, the characteristics of a learning organisation as well as on the models of innovation and technology transfer.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 1 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>

## Module 2: Sensors in industrial automation

### Module overview and training content explained

#### Module purpose and learning objectives

The main purpose of this module is to acquaint the students with the concept of sensors and their place in the structure of the automation systems. The module describes the different classification of sensors by the classification principles, and different types of sensor interfaces (for sensors with voltage output, current loop sensors, sensors with a frequency signal and pulse width modulation - PWM, digital





interfaces, digital wireless interfaces), their specifics and areas of applications.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** knowledge about the functional purpose and role of the sensors in the automation systems; the basic requirements for the sensors parameters; the functional purpose and role of the sensors in the automation system.

**Skills:** explain for measurement and control of which quantities a given type of sensor can be used; explain for measurement and control of which quantities a given type of sensor can be used; explain the sensor connection and the transmission of information when using different types of sensor interfaces.

**Competences:** refer a given sensor to respective groups of sensors according to different classification principles; describe the different types of sensor interfaces; describe the specifics of the various sensor interfaces and areas of their application.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Classification of Sensors - the main aim of this unit is to acquaint the trainees with the concept of sensors, their place in the structure of the automation systems and the classification of sensors by different classification principles:

- 1.1. Introduction to sensors
- 1.2. Classification of sensors

2) Types of sensors used in industrial automation - the main aim of this unit is to acquaint the trainees with the specific different types of sensors and their place in the structure of the automation systems.

3) Sensors interfaces - the main aim of this unit is to acquaint the trainees with different types of sensor interfaces (for sensors with voltage output, current loop sensors, sensors with a frequency signal and pulse width modulation - PWM, digital interfaces, digital wireless interfaces), their specifics and areas of applications:

- 3.1. Basic types of sensor interfaces
- 3.2. Digital interfaces
- 3.3. Wireless interfaces

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the sensors classification, different sensors types and interfaces.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 2 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>





## Module 3: Actuators in industrial automation

### Module overview and training content explained

#### Module purpose and learning objectives

The main aim of the module is to introduce to the students the concept of actuators and what is their place in an automated system. Different types of actuators will be described with potential possibility of applicability. As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** raised awareness of the industrial automation; the principle of operation of electromechanical actuators; the principle of operation of piston motors, vane motors and turbines

**Skills:** improved ability to describe main actuators and control devices used in industrial automation;

**Competences:** describe key indicators used for selection of actuator mechanisms and how they are selected.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

#### Training module structure

**Learning content:** the module is divided into three lessons:

1) Introduction to Actuators – the main aim of this unit is to acquaint the trainees with the concept of actuators, their place in the structure of the automation systems and the classification of actuators by different classification principles:

- 1.1. Industry automation, production automation, manufacturing automation
- 1.2. Nature of Actuators
- 1.3. Classification of actuators used in production automation
- 1.4. Selection of actuator mechanisms

2) Electromechanical actuators - the main aim of the lesson is to acquaint the students with the structure and principle of operation of electromechanical actuators:

- 2.1. Electrical drive
- 2.2. Design of electric motors
- 2.3. DC motors
- 2.4. AC motors
- 2.5. Pulse controlled electrical motors
- 2.6. Losses in electrical motors
- 2.7. Motor drive duty modes
- 2.8. Protection classes



3) Other types of actuators - the main aim of the lesson is to acquaint the students with the structure and principle of operation of pneumatic and hydraulic actuators and valves:

- 3.1. Pneumatically actuators
- 3.2. Air Motors
- 3.3. Hydraulic actuators
- 3.4. Hydraulic motors

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the actuators characteristics, types and structure.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 3 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>

## Module 4: Application of PLC in industrial automation

### Module overview and training content explained

#### Module purpose and learning objectives

The main aim of the module is to show why the automation is so important for nowadays industry. In the module there will be presented explanation about the role of PLCs in automation systems. Student will get knowledge about the structure of programmable logic controllers, about different types of PLCs depending on their structure and way of operation and how the PLCs communicate with real world and how they execute their tasks. Also a basic introduction to programming languages and typical instructions will be presented.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** knowledge about the properties of automation levels; the voltage levels of the signals which can be interfaced to the PLCs; how to select PLC depending on many criteria.

**Skills:** explain the goal of industrial automation; explain why PLC are very important for modern automation; explain how many steps includes the commissioning of one system based on PLC;

**Competences:** describe what contains the automation; describe the structure of programmable logic controllers; describe how to guarantee the safety work of control systems based on PL.





## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Introduction to PLC Controllers -the main aim of this unit is to show why the automation is so important for nowadays industry. In the lesson are presented the different levels of automation and is given explanation about the role of PLCs.

- 1.1. The goal of automation of industrial applications
- 1.2. Automation of product manufacturing process
- 1.3. Levels of machine automation
- 1.4. Application of Programmable Logic Controllers (PLCs)

2) Role and structure of PLC - the main aim of this unit is to describe the role and structure of programmable logic controllers. In the lesson are presented different types of PLCs depending on their structure and way of operation. It is given also explanation how the PLCs communicate with real world and how they execute their tasks.

- 2.1. Programmable Logic Controller hardware parts
- 2.2. PLC types
- 2.3. Signal types of PLC
- 2.4. How does the PLC work?
- 2.5. Multitasking

3) PLC selection, safety and commissioning - the main aim of this unit is to present how can be selected the appropriate PLC for one application and what steps includes the commissioning of one industrial project based on PLC:

- 3.1. PLC selection
- 3.2. Safety of a PLC
- 3.3. Commissioning

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the manufacturing process, roles and structures of PLC and safety and commissioning.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 4 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>



## Module 5: Industrial networks and interfaces in industrial automation systems

### Module overview and training content explained

#### Module purpose and learning objectives

This module will introduce students into Industrial Communication Networks dwells upon basic features of contemporary manufacturing and communication systems, automation and control systems with network communication and their functional distribution. The main aim of this module will be to acquaint the trainees with the features of the modern production and communication systems and their functional allocation.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Interpret the features of the communication systems; Acquire the function and the features of the communication networks; Interpret the function of the industrial computer networks; Acquire the some topologies of wireless networks; Acquire the functionalities of some contemporary wireless technologies; Acquire and distinguish separate stages (layers) and phases that the communication process undergoes.

**Skills:** Describe the characteristics of the communication systems' separate levels; Describe the properties of the wireless communications; Design communication networks with different structure.

**Competences:** Distinguish the separate types of distributed control systems; Distinguish the separate types of local networks; Distinguish the separate groups of wireless networks and their characteristics; Distinguish the separate types of network topologies.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

#### Training module structure

**Learning content:** the module is divided into three lessons:

1) Introduction to Industrial Communication Networks – The main aim of this unit is to acquaint the students with the features of the modern production and communication systems and their functional allocation, main types of communication nets, the varieties of local networks - peer-to-peer networks and client-server networks:

- 1.1. Specific features of contemporary production systems
- 1.2. Communication systems architecture
- 1.3. Characteristic features of contemporary communication systems
- 1.4. Distributed control systems – DCS





- 1.5. Automatic control systems with network communication – ACSNC
- 1.6. Functional distribution of distribution systems with network communication
- 1.7. Field level systems
- 1.8. Control level systems
- 1.9. Information level systems
- 1.10. Communication network
- 1.11. Types of communication networks
- 1.12. Types of LAN networks
- 1.13. Peer access network
- 1.14. Client – server type of network
- 1.15. Composite type of networks

2) Wireless communications in industrial environment - The main aim of this lesson is to acquaint the application of wireless communications in industrial automation systems:

- 2.1. Substance and background of wireless nets
- 2.2. Groups of wireless networks
- 2.3. High Throughput Technology
- 2.4. Medium Throughput Technology
- 2.5. Composite type of networks

3) Networks topologies and models – The main aim of this unit is to inform about a general background of network models and topologies with special consideration being given to devices for physical and logic setup of networks plus network models OSI and DoD. Trainees will be informed about the special properties and characteristics of separate network topologies (logical and physical), devices which are used for the structuring of communication networks and stages (layers) and phases that the communication process undergoes:

- 3.1. Specific features of contemporary production system
- 3.2. Bus and Ring topology
- 3.3. Star topology
- 3.4. Hierarchical and Mesh topology
- 3.5. Units for physical and logical network structuring
- 3.6. Devices for configuring network, segments and subnetworks
- 3.7. Network models
- 3.8. OSI network model
- 3.9. DoD Model

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the features of the modern production and communication systems; the application of wireless communications in industrial automation systems; networks topologies and models.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 5 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>





## Module 6: Industrial robots in automation systems

### Module overview and training content explained

#### Module purpose and learning objectives

This module will introduce students to industrial robotics particularly in relation to their use in automation systems. General knowledge about robots, some historical background, explanation what are the robots and what is the place of them in the industry will be presented. Student will gain knowledge about build and structure of industrial robots, how they can be applied or where application is not advised.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** raised awareness of the history of robots and robotics; the economic and organizational conditions; the risks connected to robotized applications.

**Skills:** awareness of the technical conditions of the robots.

**Competences:** economic and organizational conditions of this topic.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

#### Training module structure

**Learning content:** the module is divided into three lessons:

1) Industrial Robotics in automation systems – This unit is an introductory part to the module regarding industrial robots in automation systems. Here is presented general knowledge about robots, some historical background at the beginning, explanation what are the robots and what is the place of them in the industry. At the end of unit some general cons and pros are presented:

- 1.1. The origins of robots
- 1.2. Industrial robots
- 1.3. Service robots
- 1.4. Components of industrial robot
- 1.5. Application of robots
- 1.6. Benefits and constrains

2) Implementations of industrial robots - Industrial robots for larger production plants are already commonplace but with increasing boldness come to smaller companies, often family, where employment on a level of a few or dozen people working on a production shows the size of the company. Robotic therefore becomes "common" and the main areas of use of robots, due to the nature of their work is estimated as follows: the welding of approx. 30% implemented robots,



assembly stands are 20%, transport 12% and processing 6%. Other areas of activity like painting, bevelling and others, is another 30%.

In this unit issues related to robotics will be presented, what are the conditions that allow to deal seriously with the subject, in a way that such investment will provide the expected level of profit and satisfaction with robots utilisation:

- 2.1. Stages of robotization process
- 2.2. Analysis and planning of robotization
- 2.3. Implementation
- 2.4. Validation and optimization

3) Safety of robotized system - The purpose of this unit is to present the basic technical issues as well as organizational and legal matters related to design, installation and operation of robotic and automated manufacturing systems:

- 3.1. Introduction to safety
- 3.2. Legal aspects of safety of machinery
- 3.3. The requirements for machine manufacturers
- 3.4. Requirements for employers (machines users/operators)
- 3.5. The legal system in operation
- 3.6. Hazards on robotic and automated work stations
- 3.7. Other risks
- 3.8. Selection of protective measures
- 3.9. Selection of automated and robotised work stations safety standards

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the origins of the robots, robotization process, validation and optimization, safety requirements and risks.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 6 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>

## **Module 7: Technological infrastructures and industrial processes' digital transformation for manufacturing sector**

### **Module overview and training content explained**

**Module purpose and learning objectives** The module will introduce concept of technological infrastructures and digital transformation of industrial processes especially in relation to the manufacturing sector.

As a result of taking part in a training course making use of the materials in this





module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** knowledge about types of technological infrastructures in manufacturing.

**Skills:** to implement the digital technology in the broad variety of aspects of human life.

**Competences:** describe and compare different approaches to the great technology changes.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) The importance of digital transformation – The module will introduce concept of technological infrastructures and digital transformation of industrial processes especially in relation to the manufacturing sector:

- 1.1. Introduction
- 1.2. The reasons for the digital transformation
- 1.3. Uncertainties – geo-political situation, economics and demand
- 1.4. Customers' needs and demands
- 1.5. Distractive effect of the well-developed competition
- 1.6. Financial aspect
- 1.7. Summary

2) Approach to the digital transformation - Digital transformation is hard. It consumes the great amount of work and money, and even then it does not guarantee the success. Furthermore, it forces the great changes in the company, no matter what type of the industry it refers to. However, it is worth it. In some time it might even turn out to be a stage not to be skipped.

The real breakout for every business is to decide on the approach towards digital transformation. It mostly stands for the direction of the future development and for the success of the manufacturer.

In this lesson different approaches to the great technology changes are described and compared:

- 2.1. Introduction
- 2.2. Challenges
- 2.3. Approaches
- 2.4. Big change in a culture
- 2.5. Small steps
- 2.6. Departmental change
- 2.7. Starting from the bottom



3) Opportunities and challenges - Digital transformation appears in different technology trends in industrial sector. Depending on the entrepreneurship's profile or its capabilities the wide variety of different approaches, methods and technological innovations might be applied. Every single case is unique and brings different opportunities and challenges. In this part there are presented several trends which are extremely popular especially in industrial sector. Their pros and cons will be analyzed and compared:

- 3.1. Introduction
- 3.2. Automation
- 3.3. Internet of things
- 3.4. Cognitive Computing
- 3.5. Cloud Computing
- 3.6. Industry 4.0
- 3.7. Summary

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the digital transformation, different approaches and opportunities and challenges.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 7 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>

## Module 8: CNC machineries and installations

### Module overview and training content explained

#### Module purpose and learning objectives

The use of CNC machines in industry is an important part of the production of many SME companies. Knowledge needed to install, revitalizing and operating at CNC machines enables increasing of the companies competitiveness and adapt to ever-changing market conditions. The module deals with the basic division of CNC machines their installation and actual operation.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Understanding, what CNC machine is and how can be described; Understanding, how CNC machine coordinate system works; Understanding the principles of installation works of CNC machines.

**Skills:** Identifying the types and structures of CNC machines; Identifying the structures and programming of CNC program; Identifying steps for successfully operation of CNC machine.



**Competences:** Understanding the programming procedures for realisation of manufactured objects; Understanding the steps needed for CNC programming; Understanding the issues of installation and testing operation.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Definition and types of CNC machines– The lesson 1 introduces students to definition of CNC machines together with describing of their types and tools. Contains also types and characteristics of number of axes and screw mechanisms:

- 1.1. Introduction
- 1.2. Definition
- 1.3. Types and applications of CNC machine
- 1.4. CNC according to the number of axes
- 1.5. Structure of CNC machine
- 1.6. Ball screw recirculating ballscrew mechanism
- 1.7. Tool movements
- 1.8. Programming procedure for the CNC machine
- 1.9. Advantages and disadvantages of CNC

2) Coordinate systems, interpolation and programming of CNC machines - The lesson 2 introduces students to type of coordinate system together with programming structures and steps for CNC programming. Contains also computer aided part for programming:

- 2.1. Introduction
- 2.2. Cartesian coordinate system
- 2.3. Circular interpolation
- 2.4. Program structure of CNC machine
- 2.5. Steps for CNC programming and machining
- 2.6. Computer aided part programming

3) Installation and operation of CNC machines- The lesson 3 introduces students to installation issues of CNC machines together with the most important things after installation. Contains also description works and guides:

- 3.1. Introduction
- 3.2. Overview of CNC setup and operation
- 3.3. Transport
- 3.4. Installation
- 3.5. Foundation work
- 3.6. Cleaning
- 3.7. Hydraulic oil
- 3.8. Coolant
- 3.9. Power switch





3.10. What should you do before and during a cnc machine installation

3.11. Top 10 most important things to do after a cnc machine tool installation

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on types of CNC machines; coordinate systems, interpolation and programming of CNC machines; installation and operation.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 8 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>

## Module 9: Modelling and CAD design of mechanical components and devices

### Module overview and training content explained

#### Module purpose and learning objectives

The module will introduce students to the concept of CAD/CAM processing, modeling and rapid prototyping of mechanical components used in automation systems. CAD/CAM (computer-aided design and computer-aided manufacturing) refers to computer software that is used to both design and manufacture products while Rapid prototyping is a group of techniques used to quickly fabricate a scale model of a physical part or assembly using three-dimensional computer aided design (CAD) data. Construction of the part or assembly is usually done using 3D printing or "additive layer manufacturing" technology.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** raised awareness of the aim of using CAD; differences between different universal commands in CAD systems and know when to use them; the differences between parametric and direct modelling.

**Skills:** Point out the main stages of designing in CAD software; Point out why a good choice of an approach towards modelling is so important.

**Competences:** Advise which CAD program to choose in the specific case; Present advantages of the CAD over the manual drafting methods.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- Time for reading training content: 40 minutes
- Time for interactive learning (discussions, exercises, case studies, etc.): 25 minutes



- *Time for test questions: 5 minutes*

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Introduction to modelling of mechanical components – This module of the course contains information about CAD usage and its capabilities. Moreover, the whole process of designing in any of the best-known mechanical CAD software is described. There are also presented basic techniques involved in 3-D modelling and in drafting. The module summarises all of the advantages of using the CAD systems.:

- 1.1. Introduction
- 1.2. Historical aspect
- 1.3. Use of CAD
- 1.4. Usage of the CAD software
- 1.5. Advantages of CAD usage over traditional method
- 1.6. Basic functions offered while 3-D modelling
- 1.7. Additional options
- 1.8. Basic functions offered while drafting - 2D sketch
- 1.9. Other use of CAD

2) Types of CAD modelling - The main aim of this unit is to inform about the main types of CAD modelling.

- 2.1. Introduction
- 2.2. Parametric modelling
- 2.3. Direct modelling
- 2.4. Why is the choice of an approach so important?
- 2.5. Benefits and losses due to the usage of parametric modelling
- 2.6. Benefits and losses due to the usage of direct modelling
- 2.7. Processes involving parametric modelling:
- 2.8. Processes involving direct modelling:
- 2.9. Introduction to CAD software
- 2.10. CAD Kernels
- 2.11. Commercial CAD systems
- 2.12. Freeware and open source CAD systems
- 2.13. What to focus on while choosing CAD software?

3) Overview of CAD software - The main aim of this unit is to present various CAD systems. It contains their basic and additional features, offered licences and capabilities:

- 3.1. Autodesk AutoCAD
- 3.2. Autodesk Inventor
- 3.3. Dassault CATIA
- 3.4. Dassault SolidWorks
- 3.5. PTC Creo
- 3.6. Siemens NX

**Questions for reflection:** questions for reflection are offered in the learning content



aimed to make learners contemplate on the modelling of mechanical components; types of CAD modelling and CAD software

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 9 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>

## Module 10: Collaborative robots in the industry

### Module overview and training content explained

#### Module purpose and learning objectives

Collaborative robots are a new technology that requires new approaches, new methodologies and solutions. It can be said that deploying an industrial robot is now a "simple" task. For collaborative robots, we need to explore many new aspects such as knowing the possibilities of cobots, what they can do, how they behave in working with humans, what they have properties and parameters, how they are programmed, and which areas or operations are appropriate.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Understanding the role collaborative robots, their characteristics and advantages between traditional solutions; Understanding the differences between online and offline programming with basic knowledge of programming by teach method; Understanding the safety issues in collaborative robotics.

**Skills:** Identifying the possibilities for implementing of such solutions into the practices with aim of automation; Identifying the possibilities for correct decisions what kind of programming technique is best way for specific application; Identifying the contact between robot and human and also calculate and estimate the safety distance of robotic system.

**Competences:** Understanding the general view in this field and gain an potential advance at market; Understanding the programming issues in general form, based on several robots manufacturers; Understanding the risk assessment, procedures and standards that are needed during the implementation of collaborative solutions.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes



- *Time for test questions: 5 minutes*

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Introduction into the collaborative robotics – The lesson 1 introduces students to human-robot collaboration as an application which potentially improves productivity and comfort in different kind of manufacturing tasks. Lessons contain cooperation between traditionally, collaborative robots and human that are worked at same time. Now “new” forms of cooperation in this field are implementing. This makes it possible to implement it into new applications of production and assembly tasks, which are requiring concurrent flexibility and creativity.:

- 1.1. Introduction
- 1.2. Advantages and disadvantages
- 1.3. Characteristics of collaborative robots (cobots)
- 1.4. Force limited collaborative robots (cobots)
- 1.5. Types of collaboration in collaborative robotics
  - 1.5.1 Safety monitored stop
  - 1.5.2 Hand guiding
  - 1.5.3 Speed and separation monitoring
  - 1.5.4 Power and force limiting
- 1.6. Applications

2) Programming of collaborative robots - The lesson 2 introduces students to programming in various modes. With teach by demonstration technology, a graphic interface and intuitive programming methods, can students realize various cooperation tasks. Aim of the lesson is also to point of a revolution, where there is no need for an expert programmer that is costly. Any worker without knowledge of robotics or computer science can program the robot.

- 2.1. Introduction
- 2.2. Off-line programming
- 2.3. On-line programming
- 2.4. Basic knowledge of on-line programming at KUKA collaborative robot

3) Safety in collaborative robotics - The lesson 3 introduces students to directives and standards regarding collaborative robotics. Contains also describing of the new developed technical specification directly suited for collaborative robotics:

- 3.1. Introduction
- 3.2. Directives and standards
- 3.3. Risk assessment
- 3.4. Safety distance
- 3.5. Types of collaboration in collaborative robotics
- 3.6. Applications

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the importance of the collaborative robotics; directives and standards regarding safety of the collaborative robotics and programming in various modes.



# AuToMa

AUTOMATION, TECHNOLOGY TRANSFER AND  
MANAGERIAL PRACTICES FOR THE GROWTH  
OF SMES, A BETTER EMPLOYABILITY AND THE  
PROMOTION OF THE ENTREPRENEURSHIP

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 10 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=4>





## MANAGERIAL LEARNING PATH

### Module 11: Business models, innovation and competitiveness in manufacturing sector: developing medium-and long-term investments and impact

#### Module overview and training content explained

##### Module purpose and learning objectives

In this module, the student will learn the business models and the models of innovation and improvement of competitiveness in the manufacturing sector. In this way, he will acquire the tools to develop a medium- and long-term investment and impact strategy.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Understanding the role of KETs in the manufacturing sector and their impact in the European market; Students will learn aspect needed to improve the innovation and the competitiveness in the manufacturing of actual and future products from different domains: advanced materials and products, innovative manufacturing equipment, factory design, data collection and management, operation and planning, networked factories and mobile enterprises, and worker and customer centred manufacturing.

**Skills:** Identifying the importance of manufacturing sustainability in the European market; Understand the innovation in the manufacturing sector as an ensemble of items, not only the application of advanced materials and digital transformation, also new collaborative networks and the value of the knowledge workers, who will be in direct contact with new challenges.

**Competences:** Understanding the historical and environmental advance manufacturing in Europe; Know the different aspects in which an enterprise could innovate and become more competitive in the manufacturing industry.

##### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

##### Training module

**Learning content:** the module is divided into three lessons:

1) Advance manufacturing context – The lesson 1 will introduce students in the



## structure

advance manufacturing challenges and opportunities from the point of view of innovation strategy. At the end of this lesson, students will be able to understand the role of key enabling technologies (KETs) as a driver and enabler of process and product innovation, and the relation of its implantation in European market with economic, social and environmental sustainability of manufacturing in our region:

- 1.1. Introduction
- 1.2. Manufacturing the products of the future
- 1.3. What are the KETs and why are they important?
- 1.4. Advance manufacturing processes
- 1.5. Economic sustainability of manufacturing
- 1.6. Addressing economic performance across the supply chain
- 1.7. Realising reconfigurable, adaptive and evolving factories capable of small scale production
- 1.8. High performance production, combining flexibility, productivity, precision and zero-defect while remaining energy- and resource-efficient
- 1.9. Social sustainability of manufacturing
- 1.10. Increase human achievements in future European manufacturing systems
- 1.11. Creating sustainable, safe and attractive workplaces for 'Europe 2020'
- 1.12. Environmental sustainability of manufacturing
- 1.13. Optimising the exploitation of materials in manufacturing processes

2) Innovation and competitiveness in the manufacturing sector - In lesson 2, the student will discover how to innovate in the manufacturing sector and the current trends in advanced manufacturing processes, adaptive and smart manufacturing systems and digital, virtual and resource efficient factories. Finally, other topics covered will cope with the human factor as part of the factory and as a customer.

- 2.1. Introduction
- 2.2. Advanced manufacturing processes
- 2.3. Processing novel materials and structures
- 2.4. Complex structures, geometries and scale
- 2.5. Adaptive and smart manufacturing systems
- 2.6. Adaptive and smart manufacturing devices, components and machines
- 2.7. Dynamic Production systems
- 2.8. Digital, virtual and resource-efficient factories
- 2.9. Future manufacturing enterprises
- 2.10. Design and management of Production Machinery and Processes, Production Systems in Evolution and Manufacturing Strategies
- 2.11. Integration of design methods and tools
- 2.12. Collaborative and mobile enterprises
- 2.13. Human-centre manufacturing
- 2.14. Customer-focused manufacturing
- 2.15. On-demand manufacturing of customer-centred products
- 2.16. ICT Solutions for energy-efficient product life cycles and ECO-usage
- 2.17. Product-service simulation for sustainability impact

3) Business models definition and validation - In this lesson, business model for business with innovative products, which often disrupt parts of the industry value chain, will be defined from different aspects as mass customization or how to put





new products on the market quickly. The unit includes an explanation of different strategies needed in manufacturing advanced using for example, advanced materials and also a template which aims to help learners build a business model and then validate it:

- 3.1. Introduction
- 3.2. Business aspects
- 3.3. Mass customization
- 3.4. Circular economy
- 3.5. Frugal innovation
- 3.6. Business models and strategies for disruptive manufacturing processes
- 3.7. Novel supply chain approaches for innovative products
- 3.8. New models for introducing disruptive processes
- 3.9. Product life cycle management for advanced materials
- 3.10. Business model design sessions (1/7)
- 3.11. Business model design sessions (2/7)
- 3.12. Business model design sessions (3/7)
- 3.13. Business model design sessions (4/7)
- 3.14. Business model design sessions (5/7)
- 3.15. Business model design sessions (6/7)
- 3.16. Business model design sessions (7/7)
- 3.17. Business model validation
- 3.18. Business model toolbox (1/6)
- 3.19. Business model toolbox (2/6)
- 3.20. Business model toolbox (3/6)
- 3.21. Business model toolbox (4/6)
- 3.22. Business model toolbox (5/6)
- 3.23. Business model toolbox (6/6)

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the advance manufacturing context; innovation and competitiveness in the manufacturing sector and business models definition and validation

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 11 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## **Module 12: The competitive advantage through the protection of technological innovation: patents and brands**

### **Module overview and training content explained**

<b>Module purpose and learning</b>	The main aim of this module is to introduce the concept of competitive advantage and describe its nature through a brief review of related research works in the field
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## objectives

of strategic management and marketing. It discusses the sources for gaining and sustaining competitive advantage and puts an emphasis on technological innovation as one of these sources. Next part explicates the relationship between competitive advantage and branding. It presents brand loyalty and brand equity as reliable sources of competitive advantage. Finally the patent as a source of competitive advantage is presented. With this regard it raises the problem of patent infringement and argues for and against outsourcing of the production of patented technologies.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Define the concept of competitive advantage and its sources; comprehend the connection between technological innovation and competitive advantage; Explain the relationship between branding technological innovation and gaining competitive advantage; define the concept of brand equity.

**Skills:** Recognize sources of competitive advantage through case study analysis; reflect upon your company's position in the industry; Recognize advantages of two main marketing strategies – brand extension and brand portfolio diversification; reflect upon your company's marketing strategy for introducing a technological innovation to the market; identify ways of protecting technological innovations.

**Competences:** Understand competitive advantage in an industry; Understand branding as a source of gaining and sustaining competitive advantage; Recognize and evaluate patent worthiness of technological innovation.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Understanding competitive advantage – The main aim of this lesson is to introduce the concept of competitive advantage and describe its nature through a brief review of related research works in the field of strategic management and marketing. It discusses the sources for gaining and sustaining competitive advantage and puts an emphasis on technological innovation as one of these sources. The unit includes three case studies illustrating competitive advantage of three different companies. It also suggests learners reflecting upon their companies' position in the industry in order to comprehend possibilities for gaining competitive advantage:

- 1.1. Competitive Advantage: Definition
- 1.2. Sources of Competitive Advantage
- 1.3. Sources of Competitive Advantage
- 1.4. Competitive advantage: Case studies - IKEA
- 1.5. Competitive advantage: Case studies - Turing Pharmaceuticals



1.6. Competitive advantage: Case studies - Space Exploration Technologies Corp. (SpaceX)

1.7. Technological innovation and Competitive advantage

1.8. Exercise

2) Branding technological innovations- Unit 2 explicates the relationship between competitive advantage and branding. It presents brand loyalty and brand equity as reliable sources of competitive advantage. The reading material also describes two major marketing strategies a company may opt to choose for introducing its new product (technological innovation) to the market – i.e. brand extension and brand portfolio diversification. These strategies are illustrated by case studies. The unit also includes a reflective exercise, which aims to help learners make a decision about an appropriate strategy for marketing a technological innovation.

2.1. Relationship of competitive advantage to branding

2.2. Brand equity

2.3. Extending an existing brand

2.4. Building a new brand around a technological innovation

2.5. Case study 1: Trouble at SolarCity

2.6. Case Study: Max Keith's plan for the leftovers

2.7. Exercise

3) Protecting technological innovations- The aim of Unit 3 is to present the patent as a source of competitive advantage. With this regard it raises the problem of patent infringement and argues for and against outsourcing of the production of patented technologies. The unit material is illustrated by a case study, showing tragic consequences of subcontracted production of a key, patented technology. The unit also includes an exercise, which suggests watching a TED video (transcript available in all project languages).

3.1. Patents as a source of competitive advantage

3.2. Patent infringement

3.3. Patent infringement (continues)

3.4. Production of technological innovations: In-house vs Outsourcing

3.5. Case study: How to catch up to the Germans?

3.6. Exercise

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on Understanding competitive advantage, branding technological innovations, protecting technological innovations.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 12 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## **Module 13: Models of technological innovation and forms of cooperation "public-private industry sector research"**

### **Module overview and training content explained**





<p><b>Module purpose and learning objectives</b></p>	<p>The module presents the main models and tools oriented to support the SMEs for the acquisition of new technologies and implement a scientific cooperation network between enterprises, universities and research centers. The main cooperation aspects of this collaboration and the core impacts are also reviewed.</p> <p>As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following <b>learning outcomes</b>:</p> <p><i>Knowledge</i>: knowledge about the impact of an efficient management of innovation; knowledge about the role of innovation on the business process; knowledge about the importance of different entrepreneurial “profiles”.</p> <p><i>Skills</i>: verify how structure and staff can obtain advantages by industrial automation; understand the role of a learning organization; identify and evaluate the effectiveness of technology transfer</p> <p><i>Competences</i>: to differ industrial spin-offs from spin-offs of public research; to understand the importance of entrepreneurial learning and the opportunities of research valorisation</p>
<p><b>Time schedule</b></p>	<p><b>Module total workload:</b> 1 hour and 10 minutes including:</p> <ul style="list-style-type: none"> <li>• <i>Time for reading training content:</i> 40 minutes</li> <li>• <i>Time for interactive learning (discussions, exercises, case studies, etc.):</i> 25 minutes</li> <li>• <i>Time for test questions:</i> 5 minutes</li> </ul>
<p><b>Training module structure</b></p>	<p><b>Learning content:</b> the module is divided into three lessons:</p> <p>1) Models to support a cooperation network – the aim of this lesson is to present the main models and ways to support a cooperation network. In that case application of ICT to implement a scientific cooperation network between enterprises, universities and research centers. In addition, in this lesson the main obstacles to SMEs in respect to the realization of their innovation potential and their ability to improve the networks are analysed.</p> <p>1.1 Cooperation in the public-private industrial research sector 1.2 How network in manufacturing technologies can facilitated SMEs to scale up 1.3 Scientific cooperation network between enterprises and research centers 1.4 Sustainability of University-Business Partnerships 1.5 Professional profiles in collaborative research activities</p> <p>2) Actors involved in the technological transfer – the second lesson introduces the technology transfer process. It also presents different financing methods and instruments for technological transfer.</p> <p>2.1 The technology transfer 2.2 The forms of financing 2.3 Instruments supporting technological transfer</p>



	<p>3) Valorization and exploitation of results - the main objective is to explore the characteristics which support entrepreneurial activities and facilitate the generation and exploitation of knowledge and technology.</p> <p>3.1 National ecosystem 3.2 Valorization of results 3.3 Supporting the exploitation of results 3.4 Opportunities of research valorisation</p> <p><b>Questions for reflection:</b> questions for reflection are offered in the learning content aimed to make learners contemplate on the impact of innovation management and the importance of the technological transfer</p> <p><b>Test questions:</b> there are 10 test questions available at the end of the learning content.</p>
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For full Module 13 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## Module 14: Technology transfer models and implementation tools

### Module overview and training content explained

#### Module purpose and learning objectives

Technology transfer is increasingly becoming an object of interest from politicians, regions, research organizations, universities and entrepreneurs. The main reason for this module is to show a concept, tools and supporting at national and international level.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Understanding the technology transfer issues as process, methods; Understanding the technology transfer tools; Understanding the intellectual property rights.

**Skills:** Identifying the steps needed to successfully realizing of technology transfer; Identifying the best way for choose a correct transfer tool for successfully realization; Identifying the necessary steps for successfully realisation of patents.

**Competences:** Understanding the procedure and barriers of technology transfer; Understanding the procedure for implementation of technology transfer.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- Time for reading training content: 40 minutes
- Time for interactive learning (discussions, exercises, case studies, etc.): 25



minutes

- *Time for test questions: 5 minutes*

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Technology Transfer Models – The lesson 1 introduces students to technology process, transfer models and channels. Contains also describing of the basic concept of technology transfer together with its methods:

- 1.1. Introduction
- 1.2. Technology transfer process
  - 1.2.1 Steps to commercialization
- 1.3. Technology transfer models
  - 1.3.1 Four steps to successful transfer
- 1.4. Technology transfer channels
  - 1.4.1 Actors of the technology transfer
  - 1.4.2 Barriers of the technology transfer

2) Technology transfer tools- The lesson 2 introduces students to technology transfer tools as national centres, incubators, spin-off companies and many other sources of technology transfer. Contains also describing of these concepts and characteristics.

- 2.1. Introduction
- 2.2. Tool to optimize technology transfer
- 2.3. The national technology transfer centre (nttc)
- 2.4. Incubators
- 2.5. Spin-off companies
- 2.6. Technologically oriented fairs
  - 2.6.1 Reasons for participation
- 2.7. The technology exchange

3) Intellectual property protection - The lesson 3 introduces students to intellectual property rights, documentations, agreements and licencing. Contains also describing of database protection and characteristics:

- 3.1. Introduction
- 3.2. Licensing of intellectual property rights
  - 3.2.1 Licensing agreements
- 3.3. Patents
  - 3.3.1 Copyright and database protection
  - 3.3.2 Patterns of patent ownership and legal accessibility of technology
  - 3.3.3 Partnership agreements
  - 3.3.4 Patent pools
- 3.4. Advantages and disadvantages of intellectual property during transfer

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the technology transfer Models, technology transfer tools and intellectual property protection.

**Test questions:** there are 10 test questions available at the end of the learning content.



For full Module 14 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## **Module 15: Business organization and management of the innovation: strategies and change management**

### **Module overview and training content explained**

#### **Module purpose and learning objectives**

This module will deal with how manufacturing businesses confront the management of the innovation and its organization. With this module, managers and workers will be able to implement an innovation management system in their companies. They will also be able to provide outputs to improve the way their companies innovate. Finally, they will acquire precious information on how to protect and exploit the innovation results.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Explain the importance of R&D&i within the organization in manufacturing sector. Understand which steps are necessary to successfully manage innovation; To learn the minimum documentation that is necessary to present and what are the mechanisms to ensure the correct implementation of the innovation; Explain the different aspects involved in managing the innovation process in the manufacturing business; define the phases involved in the R&D&i product cycle.

**Skills:** Understand the role of the implementation of a Research, Development and Innovation management systems in order to get a real business benefits; Recognize the relevant players and the innovation mechanisms to ensure the innovation implementation; Recognize the different benefits from systematic processes in the innovation managing, the planning and organization of the process needed for R&D&i product achievement by the company and recognize the standards that affect the Management of Quality in the manufacturing enterprise.

**Competences:** To be able to apply the R&D&i management system user manual following few steps to successfully manage innovation; Recognize how the different tools can be used for the generation of ideas and ideas matchmaking, to get, at the end a R&D&i activity or project; Understand innovation managing as a key pillar of the R&D&i activities in a manufacturing enterprise.

#### **Time schedule**

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes





## Training module structure

**Learning content:** the module is divided into three lessons:

1) Introduction to innovation in manufacturing – In the previous lessons, we have checked the importance of innovation in advanced manufacturing and how it could be afforded from different aspects. In this module, and specifically in this lesson, we will understand the innovation within the organization, different types and its application, the implantation's benefits and how to manage it.:

- 1.1. Introduction to innovation in manufacturing
- 1.2. Understanding the R&D&i within the organization
- 1.3. Understanding the R&D&i within the organization
- 1.4. Understanding the R&D&i within the organization
- 1.5. Innovation common standards and its application
- 1.6. Innovation common standards and its application
- 1.7. Benefits of innovation in businesses
- 1.8. Benefits of innovation in businesses
- 1.9. First steps to successfully manage innovation
- 1.10. First steps to successfully manage innovation
- 1.11. First steps to successfully manage innovation
- 1.12. Management board responsibility
- 1.13. Measurement, analysis, improvement
- 1.14. Documentation control
- 1.15. R&D&i activities
- 1.16. R&D&i activities
- 1.17. Resources management

2) Innovation-centred organizationl aspects- Lesson 2 identifies the necessary activities to ensure that a company is fully committed to the whole process, from the initial design of the R&D&i management system through to its final deployment and maintenance. Also, this lesson outlines the responsibilities and commitment that are required at management level within a company when deploying an R&D&i management system. Special attention is given to the creation of R&D&i policies and objectives and to the set-up of R&D&i Units. Lesson 2 also describes the requirements of the different types of resources and working conditions that are involved in R&D&i activities, and explains how they should be managed and maintained by company managers.

- 2.1. Introduction
- 2.2. Documentation packages for a smooth transition into innovation
- 2.3. Documentation packages for a smooth transition into innovation
- 2.4. Documentation packages for a smooth transition into innovation
- 2.5. Identification of relevant players in the innovation uptake (internal and external)
- 2.6. Identification of relevant players in the innovation uptake (internal and external)
- 2.7. Identification of relevant players in the innovation uptake (internal and external)
- 2.8. Identification of relevant players in the innovation uptake (internal and external)
- 2.9. Identification of relevant players in the innovation uptake (internal and external)
- 2.10. Identification of relevant players in the innovation uptake (internal



and external)

2.11. Identification of innovation mechanisms to ensure the correct implementation

2.12. Identification of innovation mechanisms to ensure the correct implementation

2.13. Identification of key innovation resources

2.14. Identification of key innovation resources

2.15. Identification of key innovation resources

2.16. Main tools for the innovation brainstorming and ideas matchmaking

2.17. Main tools for the innovation brainstorming and ideas matchmaking

2.18. Main tools for the innovation brainstorming and ideas matchmaking

2.19. Main tools for the innovation brainstorming and ideas matchmaking

3) Managing innovation in the manufacturing enterprise- This lesson deals with the management of innovation without jeopardizing the creativity. This lesson addresses the importance to perform a systematic identification and analysis of problems and opportunities in the surrounding scenarios, and also, when selecting the best ideas to be implemented. Furthermore, different phases involved in the R&D&i product cycle from the initial design to the definitive commercialization in the market are explained. Three aspects to be considered for the management of the R&D&i activities within the company are described:

3.1. Introduction

3.2. Benefits from systematic processes when identifying and analysing problems and opportunities, and selecting the best ideas to implement

3.3. Benefits from systematic processes when identifying and analysing problems and opportunities, and selecting the best ideas to implement

3.4. Benefits from systematic processes when identifying and analysing problems and opportunities, and selecting the best ideas to implement

3.5. Benefits from systematic processes when identifying and analysing problems and opportunities, and selecting the best ideas to implement

3.6. Product lifecycle: From design to market

3.7. Product lifecycle: From design to market

3.8. Product lifecycle: From design to market

3.9. Product lifecycle: From design to market

3.10. Retrofitting innovation activities: Reporting, monitoring and measuring innovation results

3.11. Retrofitting innovation activities: Reporting, monitoring and measuring innovation results

3.12. Retrofitting innovation activities: Reporting, monitoring and measuring innovation results

3.13. Retrofitting innovation activities: Reporting, monitoring and measuring innovation results

3.14. Seamless process of the innovation in the business

3.15. Seamless process of the innovation in the business

3.16. Seamless process of the innovation in the business

3.17. Seamless process of the innovation in the business

3.18. Seamless process of the innovation in the business

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the innovation in manufacturing;





Understanding the R&D&i within the organization; Benefits from systematic processes and Retrofitting innovation activities

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 15 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## **Module 16: Organization of the supply in industrial sector: systems and production support processes and reorganization of logistic processes**

**Module** overview and training content explained

Module purpose and learning objectives

The supply chain today is a series of largely discrete, siloed steps taken through marketing, product development, manufacturing, and distribution, and finally into the hands of the customer. Digitization brings down those walls, and the chain becomes a completely integrated ecosystem that is fully transparent to all the players involved.

The key for a successful digital transformation of the existing supply chain, and therewith reaping the full benefits of DSC, lies in developing an orderly process for implementing and integrating the many technologies and capabilities required.

This module will develop the capabilities of the students to prepare them for the leap frog from traditional supply to fully integrated digitization system in the supply chain.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following learning outcomes:

**Knowledge:** To learn the two different strategies of supply chain management; To learn the supply chain digitization aspects taking into account;

**Skills:** To apply the best approach to each situation in your enterprise in order to decrease the Lead Time and get more benefit; To apply ERP and CPS knowledge to the manufacturing and delivery

**Competences:** Understand how the Supply Chain Management 2.0 (SCM 2.0) has revolutionized business logistics; Recognize the best tools for effective knowledge management

**Time schedule**

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes



## Training module structure

**Learning content:** the module is divided into three lessons:

1) Lean & Agile manufacturing– This unit briefly describes the Supply Chain Management evolution and depicts the main characteristics of Lean and Agile manufacturing strategies. Comparison between them is made at the end of the unit.:

- 1.1. Introduction
- 1.2. Evolution of Supply Chain Management
- 1.3. Evolution of Supply Chain Management
- 1.4. Evolution of Supply Chain Management
- 1.5. Evolution of Supply Chain Management
- 1.6. Towards Zero Lead time
- 1.7. Lean and Agile manufacturing
- 1.8. Lean and Agile manufacturing
- 1.9. Lean and Agile manufacturing
- 1.10. Lean and Agile manufacturing
- 1.11. Lean and Agile manufacturing
- 1.12. Agile Vs Lean manufacturing
- 1.13. Agile Vs Lean manufacturing

2) Digitisation of the supply chain- To stay competitive in today's digital market, companies often have to invest in expensive digital technologies for supply chain for example. In this lesson we introduce the trends in organization of the supply in industrial sector, for example how to reorganize the logistic processes to get a significant competitive advantage or how to simplify adaptivity using platforms and apps.

- 2.1. Introduction
- 2.2. Collaborative Manufacturing and Logistics
- 2.3. Collaborative Manufacturing and Logistics
- 2.4. Collaborative Manufacturing and Logistics
- 2.5. Collaborative Manufacturing and Logistics
- 2.6. Deploy a chain supply from ERP and CPS to manufacturing and delivery
- 2.7. Deploy a chain supply from ERP and CPS to manufacturing and delivery
- 2.8. Deploy a chain supply from ERP and CPS to manufacturing and delivery
- 2.9. Deploy a chain supply from ERP and CPS to manufacturing and delivery
- 2.10. Simplify adaptivity of chain configuration using platforms and apps
- 2.11. Simplify adaptivity of chain configuration using platforms and apps

3) Servitization of autonomous and reconfigurable production- In the previous lessons, we have checked the importance of investment in digital technologies for supply chain. During this lesson we will understand the benefits of transforming traditional manufacturing in an autonomous and a reconfigurable industry, for example, offering Manufacturing as a Service:

- 3.1. Introduction
- 3.2. Introduction
- 3.3. Introduction
- 3.4. Application of technologies to industrial automation with Cloud, IoT and CPPS environments: Cyber-Physical Systems (CPS)
- 3.5. Application of technologies to industrial automation with Cloud, IoT and CPPS environments: The Internet of Things (IoT)



- 3.6. Application of technologies to industrial automation with Cloud, IoT and CPPS environments: Cyber Physical Production Systems (CPPS) environments
- 3.7. Application of technologies to industrial automation with Cloud, IoT and CPPS environments: Cyber Physical Production Systems (CPPS) environments
- 3.8. The Cloud Manufacturing
- 3.9. The Cloud Manufacturing
- 3.10. Smart Factory
- 3.11. Servitization of manufacturing
- 3.12. Service as creating a market place for manufacturing services
- 3.13. Service as creating a market place for manufacturing services
- 3.14. Specific solutions that need to be addressed by the research or innovation activities.

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the Lean & Agile manufacturing, Digitisation of the supply chain, servitization of autonomous and reconfigurable production.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 16 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## **Module 17: Financial instruments and incentives for research, technological innovation, funding and incentives (regional, national, European)**

### **Module overview and training content explained**

#### **Module purpose and learning objectives**

EU funding programmes cover the major European issues: education, research, environment, transport, culture. These grants are available to all public, private or non-profit organizations. This module has the purpose to present to the learners the various sources of funding for research and technological innovation. The module contains general introductory part on how to participate in EU programmes and European grants and specific sections for each of the partner countries.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Define the concept of a project; comprehend the key aspects of the project development process; learn about the particular funding opportunities offered by the European Union.; knowledge about the specific funding programmes available in each of the partner countries.

**Skills:** Perform logical framework analysis; reflect upon the company's needs,





constraints and opportunities for development; recognize programmes which are suitable for the specific type of organization; reflect upon the company's strategy for providing funding for technological innovation and transfer; Distinguishing between various programmes, the activities they finance and the eligible costs.

**Competences:** Understand project development and management; Understand the various funding opportunities; Finding relevant funding for own project ideas.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) European programs for research and technological innovation – lesson 1 provides detailed information about the EU Competitive Programmes (programmes financed directly from the EU's budget in the form of grants and covering priorities, as defined by the EU and aimed at contributing to the implementation of EU policies).

1.1 Introduction

1.2 Overview of funding programmes for the period 2014-2020

1.3 HORIZON 2020: The SME Instrument

1.4 COSME: Europe's programme for SMEs

1.5 Case Study: Innovation in the textile industry in Bulgaria

1.6 Investment development in the research and technological innovation in the past few years

1.7 Future trends

2) Funding and investment for technological innovation - lesson 2 provides detailed information about the different kinds of funding initiatives that are supporting technological innovation across Europe.

2.1 Introduction

2.2 Public sector opportunities

2.3 Foundations and crowd funding

2.4 Other helpful resources

2.5 Building a successful fundraising strategy (part 1)

2.6 Building a successful fundraising strategy (part 2)

2.7 Profile of the fundraising expert

3) Developing projects and applying for funding - The lesson introduces the concept of European project through a brief review of related sections usually included in a project application form. It provides useful tips on the preparation of applications for funding. The unit suggests learners to reflect upon their companies in order to comprehend possibilities for obtaining a grant to fund their ideas.

3) Developing projects and applying for funding - the lesson introduces the concept



of European project through a brief review of related sections usually included in a project application form. It provides useful tips on the preparation of applications for funding. The unit suggests learners to reflect upon their companies in order to comprehend possibilities for obtaining a grant to fund their ideas.

### 3.1 Introduction

### 3.2 Project Development – Logical Framework Approach (LFA)

### 3.3 The Project Development Matrix (LogFrame)

### 3.4 Useful tips for developing a project

### 3.5 Project assessment

### 3.6 Multi-, inter-, or transdisciplinary

### 3.7 Finding reliable partners for EU projects

**Questions for reflection:** questions for reflection are present in the learning content aimed to make learners contemplate on the importance of financial instruments for technical innovation, EU programmes and structural funds.

**Exercises/Case studies:**

1. Innovation in the textile industry in Bulgaria
2. Kickstarter project – an example of innovative crowdfunding campaign

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 17 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>

## **Module 18: Creation of new businesses "knowledge based" and entrepreneurship: implementation modalities and instruments**

### **Module overview and training content explained**

#### **Module purpose and learning objectives**

According to the “SMEs, Entrepreneurship and Innovation” paper developed by OECD in 2010, new SMEs and innovating ones are seen as agents of change in the economy, introducing new products and services and more efficient ways of working. They can be considered as drivers for the economic development of any country and directly related to the phenomenon of knowledge-based economy.

Thus, the module on “Creation of new businesses "knowledge based" and entrepreneurship: implementation modalities and instruments” aims to provide the representatives of the AuToMa target groups with scientific and practical knowledge about innovation and entrepreneurship along with the skills to turn such knowledge into practice. Overall, the document consists of information on the modalities and instruments for implementation of knowledge-based businesses and entrepreneurship including: the main definition of knowledge-based businesses and entrepreneurship (KBE) concepts; knowledge management; strategy of knowledge-



based firms and examples of KBE models being implemented in actual firms.

KBE is associated with the knowledge economy which characterized by the crucial role of information and communication technologies, the high proportion of knowledge-intensive activities, the greatest variety of intangible resources in relation to the research and development data. When referring to KBE, the role of creating new knowledge should be considered central to value creation. But knowledge does not automatically lead to innovation and economic growth. Focusing on the definition of KBE at the SME level, there are five key features:

1. New firms;
2. Innovative firms;
3. Firms with significant knowledge intensity in their activities;
4. Firms exploiting innovative opportunities in various sectors;
5. Firms achieving competitive advantage.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Tell the difference between the three phenomena; discover the origin of the terms; To learn the knowledge management features and challenges; to learn how to develop a successful knowledge management strategy and to implement it; To learn about the most practical tools to get started or to assist a knowledge-management implementation.

**Skills:** To apply practical tools for implementation of effective knowledge management; To make an informed decision on what is a knowledge-based business, entrepreneurship and economy and what is not; Recognize the steps to be undertaken in order to facilitate knowledge management at a company.

**Competences:** Be able to recognize the characteristics of the knowledge-based economy, entrepreneurship and businesses; Recognize and manage the knowledge flow within an organization; Recognize the best tools for effective knowledge management.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Main concepts of knowledge-based economy, businesses and entrepreneurship – The main aim of this lesson is to introduce the following concepts: knowledge-based economy, knowledge-based entrepreneurship and knowledge-based businesses. The paper presents different points of view regarding the terms and when they appeared in the literature. A great focus is put on the importance of



knowledge-based entrepreneurship ecosystem, the actors involved in it and the factors affecting it. A case study of knowledge-based entrepreneurship ecosystem is presented showcasing the process of developing such an ecosystem. The elements of knowledge-based business are also reviewed:

- 1.1. Main concept of knowledge-based economy
- 1.2. Main concept of knowledge-based entrepreneurship
- 1.3. Knowledge-based entrepreneurship ecosystem – Part 1
- 1.4. Knowledge-based entrepreneurship ecosystem – Part 2
- 1.5. Case study of knowledge-based entrepreneurship ecosystem
- 1.6. Main concept of knowledge-based businesses – Part 1
- 1.7. Main concept of knowledge-based businesses – Part 2
- 1.8. Exercise

2) Knowledge management (KM) concept and tools - Unit 2 Knowledge management (KM) concept and tools aims to present the knowledge management concept and importance. It also elaborates on the knowledge management strategy characteristics and approaches. Tips about successfully developing a KM strategy are shared along with supporting questions for an organisation to use. Then an exemplary logical knowledge management model is presented with a framework development and a case study of implementation of the model in real life. A success story of a Germany-based firm applying knowledge management system is described.

- 2.1. Knowledge management concept
- 2.2. Knowledge management strategies
- 2.3. Approaches to developing knowledge management strategies
- 2.4. Characteristics of a successful knowledge management strategy
- 2.5. Specific aspects to be considered by the company's management regarding the Knowledge management strategy
- 2.6. Knowledge management framework - Part 1
- 2.7. Knowledge management framework - Part 2
- 2.8. Knowledge management success story
- 2.9. Exercise

3) Knowledge management implementation tools and techniques for small and medium-sized enterprises - Unit 3's aim is to present the tools, techniques and methods to be used in a knowledge-management initiative in small and medium-sized enterprises.

- 3.1. Five-step knowledge-management (KM) process
- 3.2. List of techniques and tools based on the Five-step knowledge management process
- 3.3. APO Knowledge Management Assessment Tool - Part 1
- 3.4. APO Knowledge Management Assessment Tool - Part 2
- 3.5. Mentor/Mentee tool
- 3.6. Taxonomy tool
- 3.7. Knowledge Clusters
- 3.8. Exercise

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the main concepts of knowledge-based



# AuToMa

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economy, concept, tools and five step knowledge management process.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 18 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>







## Module 19: Marketing and communication of innovation

### Module overview and training content explained

#### Module purpose and learning objectives

The main purpose of this module is to present strategies for communication of innovations by introducing informational and transformational approaches; provide guidelines for competitive landscape analysis and explains the importance of market segmentation; introduce the strategies for bringing to the market stand-alone disruptive innovations.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Understand and define value proposition of innovation; recognize difference between value proposition of disruptive and sustaining innovation; Comprehend the difference in commercialization of stand-alone science- / technology-driven innovation, stand-alone market-driven innovation, and incremental innovation; Distinguish between different communication channels; comprehend their application for communicating innovation.

**Skills:** Apply tools for customer value analysis; Make an intelligent choice of a strategy for bringing innovation to market; Make an intelligent decision regarding the choice of channels for communicating innovation.

**Competences:** Synthesize and formulate the value proposition of innovation; Understand market entry strategies for innovations; Recognize an effective strategy for communicating innovation.

#### Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

#### Training module structure

**Learning content:** the module is divided into three lessons:

1) Understanding the value proposition of innovation – The main aim of this lesson is to introduce the concept of customer value proposition and how it should be reflected in a company's offering of an innovation. The unit also provides guidelines for competitive landscape analysis and explains the importance of market segmentation for the right positioning of an innovation in the marketplace. As the last part of the reading material, it relates the concept of "product differentiation" to customer value creation and to winning against the competition:

- 1.1. Customer value proposition
- 1.2. Disruptive vs sustaining innovation and their value proposition
- 1.3. Case study: How cold is cold beer?
- 1.4. Competitive landscape analysis (part 1)
- 1.5. Competitive landscape analysis (part 2)



- 1.6. Gathering information about competitors
- 1.7. Product differentiation - Points of parity (POPs)
- 1.8. Product differentiation - Points of difference (PODs)
- 1.9. Exercise

2) Bringing innovation to market - The main aim of this lesson is to introduce the strategies for bringing to the market stand-alone disruptive innovations and incremental innovations. It highlights the commercialization differences of science- or technology-driven innovations and market-driven innovations. Each strategy, described in the unit, is illustrated by a case-study.

- 2.1. Science- or Technology-Driven Innovation
- 2.2. Case study: Kevlar by DuPont
- 2.3. Stand-alone Market-Driven Innovation
- 2.4. Case study: Xerography
- 2.5. Strategy: High corporate resistance to innovation
- 2.6. Strategy: Low corporate resistance to innovation
- 2.7. Case study: Listerine Breath strips, invented by Pfizer
- 2.8. Incremental innovations
- 2.9. Exercise

3) Communicating innovation - The main aim of this lesson is to present strategies for communication of innovations by introducing informational and transformational approaches. It describes various communication channels, distinguishing between personal and non-personal ones. The unit argues for the need to use a mix of different channels to make communication of innovation effective:

- 3.1. Communication objectives
- 3.2. Communication strategies
- 3.3. Communication channels mix
- 3.4. Personal and non-personal communication
- 3.5. Voice of customer
- 3.6. Exercise

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the the value proposition of innovation; strategies for communication of innovations and bringing innovation to market

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 19 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>



## **Module 20: Cooperation, networking and interaction between SMEs, public sector and financial institutions**

### **Module overview and training content explained**

#### **Module purpose and learning objectives**

In a knowledge-based economy competitiveness is becoming more dependent upon the ability to apply new knowledge and technology in products and production processes. However, with growing competition and globalisation and the rapid advancement of knowledge, new technologies and innovative concepts have a wider variety of sources, most of them outside the direct control of firms that have become more specialised and focused on their core competencies. For complementary knowledge and know-how, they increasingly rely on collaborative arrangements, in addition to market-mediated relations (e.g. purchase of equipment, licensing of technology). Inter-firm collaboration within networks is now by far the most important channel of knowledge sharing and exchange. Interactions are also intensifying between firms and a number of other institutions involved in the innovation process: universities and other institutions of higher education, private and public research labs, providers of consultancy and technical services, regulatory bodies, etc.

As a result of taking part in a training course making use of the materials in this module, learners are expected to achieve the following **learning outcomes**:

**Knowledge:** Distinguish business networks from clusters, distinguish knowledge transfer from knowledge diffusion; understand the principles of clustering; comprehend the opportunities of digital platforms for the internationalization of small companies; gain knowledge about the European cluster collaboration platform; Define the concept of a networking; comprehend the key benefits of networking to the company; comprehend the barriers which the companies face when networking; understanding of the government support for encouraging SME networking and collaboration; Define the different networking strategies an SME can undertake; understand the principles of netiquette; comprehend the opportunities of social networks for business purposes; knowledge about the various internet supporting tools for business networking.

**Skills:** improved skills for self-reflection; improved skills to identify benefits of clusters; Distinguishing between different types of networks; performing benefits analysis of the networking opportunities; identifying obstacles to networking; Perform networking activities with competence and confidently; distinguish between the different networking strategies; reflect upon the strong and weak sides of their personality and the company; prepare and present an elevation speech; improved skills for networking especially in social media.

**Competences:** Understand knowledge flow within an economy; building a successful and sustainable business networks; Understanding the networking process and how it creates value for the business; Understand SME networking strategies; understand appropriate networking behaviour; building a successful



business profile online.

## Time schedule

**Module total workload:** 1 hour and 10 minutes including:

- *Time for reading training content:* 40 minutes
- *Time for interactive learning (discussions, exercises, case studies, etc.):* 25 minutes
- *Time for test questions:* 5 minutes

## Training module structure

**Learning content:** the module is divided into three lessons:

1) Business clusters – Unit 1 aims to present the concept of business clusters, the factors for success of such clusters and the benefits for SMEs for involving in clusters. Factors such as globalization, localization, knowledge transfer, interaction with university and the role of digital platforms are explored.

- 1.1. Introduction
- 1.2. Clusters and networks
- 1.3. Factors of success of a cluster
- 1.4. Benefits of clustering
- 1.5. The European cluster collaboration platform
- 1.6. Globalization
- 1.7. Localization
- 1.8. Knowledge transfer and knowledge diffusion
- 1.9. The role of universities in the reinforcement of SMEs
- 1.10. Digital platforms in globalization era
- 1.11. Conclusion

2) Business networking - benefits and obstacles to SMEs - unit 2 introduces the concept of business networking as opposed to personal networking. After a brief review of the potential benefits for a company from networking, the unit continues with list of the internal and external obstacles SMEs face to seizing networking opportunities.

- 2.1. Introduction to networking
- 2.2. Types of networks
- 2.3. Types of networks (continues)
- 2.4. What are the key benefits of networking/partnerships for smes?
- 2.5. What barriers may prevent smes realise the benefits of networking?
- 2.6. Government support for enhancing networking

3) Strategies for successful business networking - Unit 3 summarizes the various strategies an SME can undertake in order to network. The second part of the unit puts an emphasis on the practices and networking etiquette, which has to be followed in order to guarantee positive outcomes of your networking efforts. The unit also suggests learners a reflection exercise with the help of which to develop their own “elevator speech” which can be practiced and further refined in the next networking event.

- 3.1. Networking strategies for SMEs
- 3.2. Before a networking event
- 3.3. Exercise “elevator speech”





- 3.4. Winning strategies during networking events
- 3.5. Winning strategies during networking events (continues)
- 3.6. Social networking for business purposes
- 3.7. Web and mobile applications for business networking
- 3.8. Netiquette
- 3.9. Building a strong LinkedIn profile

**Questions for reflection:** questions for reflection are offered in the learning content aimed to make learners contemplate on the importance of the concept of business clusters; the factors for success; strategies for successful business networking and events.

**Test questions:** there are 10 test questions available at the end of the learning content.

For full Module 20 training content, please visit: <http://www.automa-course.piap.pl/en/course/view.php?id=3>