

Upskilling Lab 4.0

No 2019-1-BG01-KA204-062308

IO2

SKILLS DEVELOPMENT FRAMEWORK

FINAL VERSION

2020/07/26

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Index

1	Introduction	3
2	Learning model Cycle	3
	2.1 Experiential Context	4
	2.2 Reflective Observation	5
	2.3 Conceptualization	5
	2.4 Active Experimentation	6
	2.5 Assessment	6
3	Bloom's Taxonomy	7
	3.1 Bloom's taxonomy outlook	7
	3.2 Why is Bloom's taxonomy important?	8
	3.3 Learning objectives in Bloom's taxonomy	9
	The cognitive domain in Bloom's taxonomy	9
	The affective domain in Bloom's taxonomy	10
	The psychomotor domain in Bloom's taxonomy	10
	3.4 Behaviour description and Verbs	10
	Cognitive domain	10
	Affective domain	11
	3.5 Activities & Assessment in Bloom's Taxonomy	12
4	Upskilling Lab 4.0: 8 macro competences to foster collaboration between start-ups and corporations	15
	4.1 First approach: Collaboration Management Framework	15
	4.2 Grouping the key skills to frame successful collaboration: 8 skill cards	16
5	Grounding up Upskilling Lab 4.0 Activities and Assessments	17
	5.1 Equivalences between Bloom taxonomy domains and Upskilling Lab 4.0 levels	17
6	Applying Upskilling Lab 4.0 Activities (A) & Assessments (E)	19
	7 Bibliography	25
	Web References:	25
	Annex 1: Collaboration Management Framework	26
	Annex 2: Basics of the skill cards	26
	Annex 3: 8 Skill cards	26

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

1 Introduction

From an operational point of view, a learning-teaching framework is designed to guide the work of trainees and instructors. Hence, the framework clarifies assumptions about successful learners and effective learning.

A competence development model, such as the one Upskilling Lab 4.0 project is for, must favour a meaningful learning. To this end, it must be focused on the learner, promoting his/her knowledge, skills, attitudes and competences.

This learning-teaching framework is designed trying to offer a comprehensive model to develop each and the all 8-macro competences that Upskilling Lab 4.0 proposes to enhance the collaboration between start-ups and corporations to foster entrepreneurship and open innovation.

To come to this end, the proposal draws on:

- a) Entrecomp and DigComp frameworks, which are cornerstones of Upskilling Lab 4.0 project. When analysing these frameworks, we have to pay attention not only to content but also that both have been devised to be developed following a progression model to achieve different mastery levels.
- b) The educational models (UD Educational and Learning models) that the University of Deusto developed 20 years ago to embrace the revolution that the so known Bologna Declaration (1999) implemented in the European Higher Education Area (EHEA). It must be noticed that University of Deusto belongs to the Society of Jesus, which from its inception in 1540 has devoted to education and that it is acknowledged as the “greatest multinational” in education (covering all levels) all over the world.

So building upon both, and taking into account Bloom's taxonomy (present, as well, on DigComp framework), it has been conceptualized this blended approach as a guide for the two protagonists of the process, learners and instructors, offering a high degree of flexibility to be enhanced by each of them -separately and jointly- and as they become more fluent using it.

2 Learning model Cycle

Learning cannot be based on a passive and receptive attitude, but must encourage search, initiative, reflection, and action. In order to develop meaningful learning, the different ways of thinking that the learner puts into play in the interaction with the contents and knowledge must be worked on.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

Cognitive capacities, more than previously elaborated concepts, are the tools that will allow knowing and understanding approaches and theories and, at the same time, developing skills for their meaningful integration.

Learning focused on the mere acquisition and reproduction of information does not generate knowledge. Therefore, the methodological approach must consist of the continuous and systematic exercise of the development of thought. Learning in a meaningful way implies applying thinking by combining observation activities and their contextualization with reflective activities that help to understand situations and contents.

Learning can be modelled as a five-step cycle like shown in Figure 1.

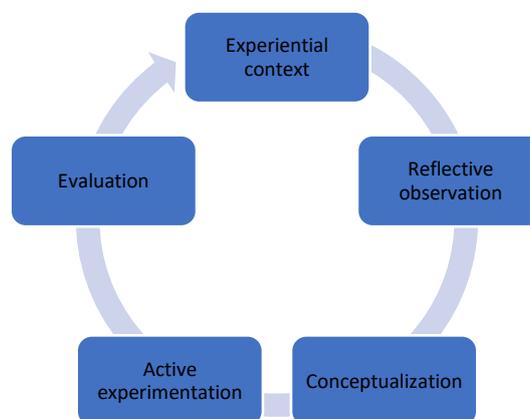


Figure 1 – Learning model cycle

2.1 Experiential Context

Learning originates in a contextualized environment. Trainees start learning from one's own current knowledge and context and from social, political, economic, and cultural environments. To understand a situation, a problem, it is necessary to understand the context in which it is embedded. For information to become knowledge, it is essential to contextualize it so that the person can incorporate it significantly into his or her mental structure.

The starting point of learning is the learner with his/her motivations, expectations, capacities and skills and emotional limitations. Interest can be perceived as a disposition towards the cognitive or affective content. Interest in learning has a powerful cognitive result and is key in the initial levels of learning. People who show interest in particular activities or topics pay greater attention, persist longer in prolonged periods, learn more, and become involved with a greater degree of enjoyment than individuals who do not have such interest. Main sources of interest are found in novelty, intensity and uncertainty.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

In this first step of learning, different strategies can be introduced to help trainee to ask questions to contextualize the 8 macro competences Upskilling Lab 4.0 is based on, either individually or collaboratively, exchanging views and analysing common and dissenting aspects in groups: links with other contexts, diverse experiences, preconception analysis, expectations, data to help contextualization, common and differing perceptions of participants.

In short, this first step tries to place the learner in front of the topic or issue (skill in this case) to be developed so that she gets a first global approach to the topic and gets predisposed and involved in the learning process.

2.2 Reflective Observation

Observation is a natural method of learning, but observation becomes relevant when accompanied by reflection or interiorization.

Reflective observation consists of perceiving the reality that surrounds us and then, questioning through reflection the considerations that this observation means in the form of ideas, objects, goals, contents or behaviours. Reflection allows us to bethink the observed data and focus our knowledge and analysis on them.

This phase of learning helps to question things, their use and application, their interest, their effects on others, etc. The purpose of this phase is for the learner to ask questions, to question, since there can be no significant learning if one does not ask questions and interrogate oneself about it.

Questioning and seeking answers from the learners should be encouraged. In addition, sharing questions and reflections can be a first step, for example, in initiating teamwork. Some of these questions could be: What is my interest? What contradictions does it imply to me? How does this affect my personal convictions? How does this challenge me? What can I do?

2.3 Conceptualization

Next step is to know as deeply as possible the theoretical issues on each topic. In this phase, the aim is to bring the theory closer to the student.

Conceptual learning is based on the acquisition of knowledge, scientific terminologies, facts and data, methods and strategies, principles and theories. It is not about memorizing but about learning based on the use and application of cognitive skills such as understanding, analytical-synthetic thinking, critical judgment, divergent thinking, which allows for integrated and meaningful learning. In this way, trainees situate concepts or data in her own intellectual structure and add relevant knowledge to her personal skills enhancing one's own warehouse of knowledge.

Questions that allow this knowledge to be consolidated are linked to issues such as these: understanding of scientific terminologies, specific glossary management, differences and similarities between diverse theories and perspectives, causes and effects of models, main results of studies and research, analogies/comparisons between approaches/models,

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

alternatives or strategies to the same theoretical or practical situation and ways to solve the problem, etc.

The approach to conceptualization can be arranged individually or in teams and adapted to the distinctive characteristics of each learner.

2.4 Active Experimentation

This phase of learning concerns the link between theory and practice. It includes any activity that favours the development of trainee's skills and abilities in the application of concepts, theories or models in order to obtain a greater strengthening of these, with a purpose of solving problems, or with the aim of carrying out a design or implementation of a model or strategy.

Therefore, this phase is configured by any type of activities, exercises, practices, projects, designs, or any other active proposal that the learner must carry out, complementing this practical or applied vision with the theoretical-conceptual framework in which it can be included.

Questions that can help to develop this step refer to two areas, Technical and Social, being both of them the scope of the 8-macro competences promoted by Upskilling Lab 4.0 project.

Technical questions refer to procedures, strategies, methods to carry out a task or project, alternatives or options for methodology, resources, advantages and limitations of each possible option or alternative.

Social questions refer to how these activities affect people, what social, ecological, political, economic and other repercussions they have, anticipate consequences and effects that these activities may have on others, etc.

The active experimentation phase is very well suited to collaborative work, since this phase requires the application of different skills and competencies that can be shared by various members of a team.

2.5 Assessment

We can distinguish three levels of assessment relevant to trainee development:

- Personal level. It is not a technical question but fundamentally one of reflection, linked to trainee's personal capacities, limitations and motivations and to his or her attitudes. It is a matter of making the learner reflect, of facing up to what she learns formally and informally, and of linking that learning to oneself.
- Training level. It is based on the consideration of feedback as a key element for the progress of learners. Obtaining feedback on learning, the main difficulties and obstacles, the failures to be corrected; it is the basis for improvement and optimum use. This assessment can be carried out through different strategies: formative self-evaluation, diagnosis of learning style, feedback on exercises and activities through tools such as the portfolio and personalized follow-up of the trainee.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



- Summative level. The purpose of this evaluation is to assess the "accountability" of each trainee's work and study. It is therefore a matter of assessing the performance achieved by the learner which leads to accredit a level of competence achieved.

This type of evaluation is carried out through multiple methods such as tests of knowledge, research work and projects or evaluation of skills.

3 Bloom's Taxonomy

3.1 Bloom's taxonomy outlook

Bloom's Taxonomy is a classification of the different objectives and skills that instructors set for their trainees: learning objectives. The taxonomy was proposed in 1956 by Benjamin Bloom, (Bloom, Englehart, Furst & Hill, 1956), an educational psychologist at the University of Chicago. This taxonomy provides a hierarchical ordering of cognitive skills and is used worldwide to help inform successful teaching practice.

In a few words, Bloom's taxonomy is a framework for educational achievement based in hierarchical levels, and often depicted in form of a pyramid.

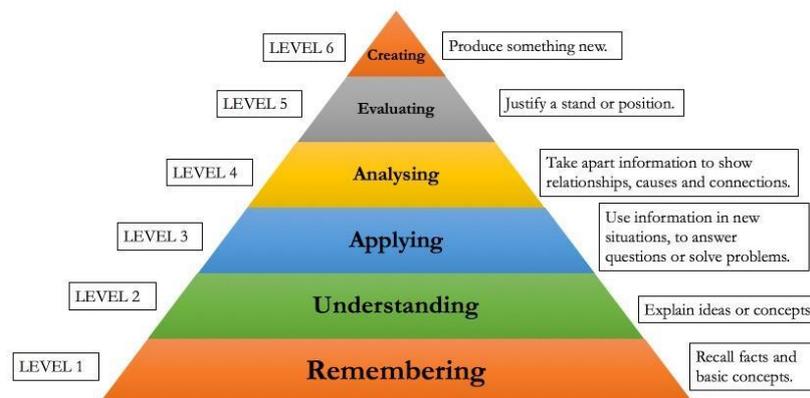


Figure 2 - Bloom Taxonomy Pyramid

The foundation of the model implies that trainees move up through each level of the pyramid in Bloom's taxonomy, starting from very basic learning, to acquiring deeper knowledge on a subject, with each level becoming crucial to the development of the next.

As a framework to support learning, Bloom's taxonomy is the most widely used and enduring tool to consider apprentice learning. It can be observed (e.g: DigComp framework), to a greater or lesser extent, in schemes and assessment objectives provided by all examining bodies in almost any curriculum subject.

Bloom's taxonomy is a practical tool to use, providing a framework in which to plan challenging programs that help to ensure trainees' progress is maximised. Among its many uses, Bloom's

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

taxonomy offers a framework in which to deliver appropriate objectives and outcomes, questioning and activities, and assessment. Instructors can apply Bloom's taxonomy by asking questions and delivering assignments directly correlated with specific learning objectives in each stage of the process.

The paradigm developed by Bloom et al. (1956) is framed in six categories: Knowledge, Understanding, Application, Analysis, Synthesis and Evaluation. The categories following Knowledge were presented as "skills and abilities", with the understanding that knowledge was the necessary precondition for putting those skills and abilities into practice.

Krathwohl & Anderson (2001) published a revision of the 1956 hierarchy and their proposal, adapted, inspires the present framework. It is important to note that the different levels of thinking defined within each domain of the taxonomy are hierarchical. In other words, each level subsumes the levels that come before it.

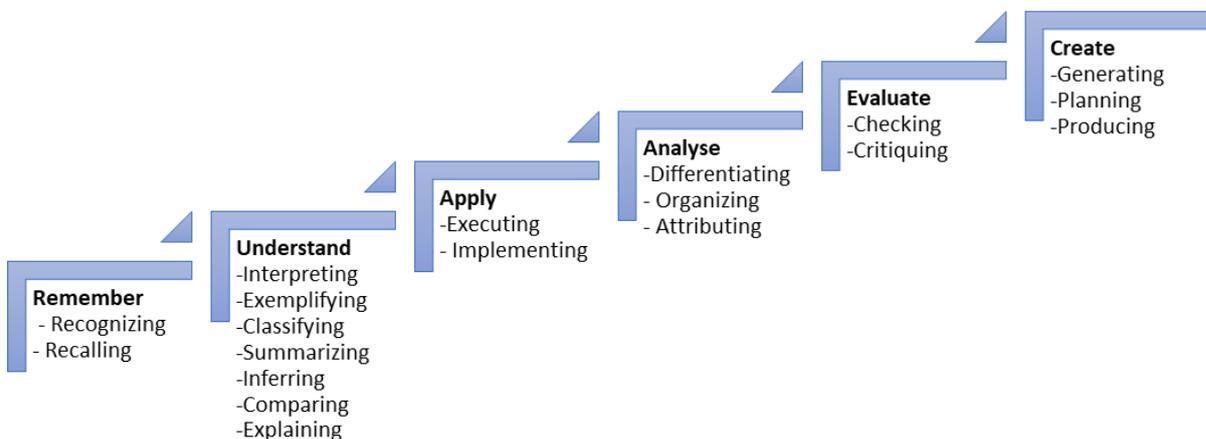


Figure 3 - Anderson and Krathwohl's (2001) revision to Bloom's cognitive hierarchy

Bloom's Taxonomy comprises three learning domains: the **cognitive**, **affective**, and **psychomotor**, and assigns to each of these domains a hierarchy that corresponds to different levels of learning.

3.2 Why is Bloom's taxonomy important?

Bloom's taxonomy has been actively used by teachers for over five decades. Yet it is still just as important today as back in the '50s. The authors of the revised taxonomy suggest a multi-layered answer to this question with the following clarifying points:

- Objectives (learning goals) are important to establish in a pedagogical interchange so that instructors and trainees alike understand the purpose of that interchange.
- Organizing objectives helps to clarify objectives for themselves and for trainees.
- Having an organized set of objectives helps instructors to:
 - "Plan and deliver appropriate instruction";

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



- “Design valid assessment tasks and strategies”;
- “Ensure that instruction and assessment are aligned with the objectives”.

Using the prosed categorization, instructors can effectively organize objectives and create lesson plans with appropriate content and instruction to lead learners up the pyramid of learning. Instructors can also design valid assessment tools and strategies to ensure each category is met in turn, and that each part of the course material is in line with the level’s objectives, whether it’s basic knowledge at the beginning of a course or applying that knowledge towards the middle of the process, and so on.

At the end of the learning process, the goal with Bloom’s taxonomy is that a trainee has honed a new skill or level of knowledge, and that instructor can effectively assess this learning on an ongoing basis, as the course moves through each stage of the framework.

3.3 Learning objectives in Bloom’s taxonomy

Bloom’s taxonomy is further divided into three distinct learning objectives, or domains of educational activities: cognitive, affective, and psychomotor. These are also referred to by the acronym KSA, for Knowledge (cognitive), Attitudes (affective), and Skills (psychomotor).

The goal is that by the end of a learning session, the trainee will have acquired new knowledge, skills, and attitudes towards a subject.

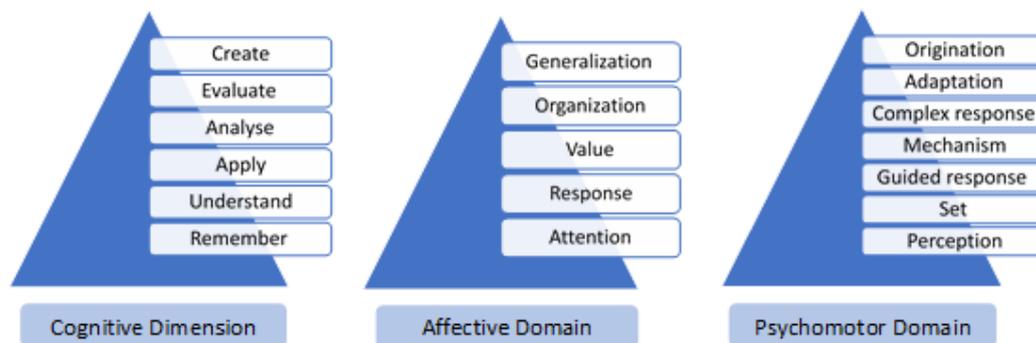


Figure 4 - KSA hierarchies

The cognitive domain in Bloom’s taxonomy

Knowledge and development of intellectual skills places at the heart of the cognitive domain of Bloom’s taxonomy, whereby a trainee can recall or recognize facts, patterns, and concepts that will serve as a foundation for deeper learning. This is where the six key facets of Bloom’s taxonomy — Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation—come in.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

The affective domain in Bloom's taxonomy

In this domain, trainees have new feelings or emotions about the subject, and/or themselves. They should be able to place more value on something, and have a greater appreciation for it, along with different motivations and attitudes. In a medical or caregiving setting, trainees might be able to demonstrate empathy towards patients or children. Trainees can be assessed in several ways when it comes to the affective domain, such as their ability to listen with respect and provide their unwavering attention, actively participate in class discussions, resolve conflicts and exhibit consistent and pervasive behaviours that reflect their internalized values.

The psychomotor domain in Bloom's taxonomy

The psychomotor domain is one of the later additions to Bloom's taxonomy. In this domain of Bloom's taxonomy, learners develop manual or physical skills. There are three versions: physical movement, coordination and the use of motor skills and, consequently, will not be used in Upskilling framework.

3.4 Behaviour description and Verbs

Cognitive domain

The cognitive domain is focused on intellectual skills such as critical thinking, problem solving, and creating a knowledge base. It was the first domain created by the original group of Bloom's taxonomy researchers. The cognitive hierarchy spans from simple memorization designed to build the knowledge of learners, to creating something new based on previously learned information. In this domain, learners are expected to progress linearly through the hierarchy, beginning at "remember" and ending at "create."

Table 1 summarizes the description of these cognitive models and an extensive sample of verbs related to each of the cognitive domains, which should be useful to contrast the Upskilling Lab 4.0 model to Bloom's Taxonomy.

Cognitive Level	Description	Samples of action verbs in each Cognitive Domain
Remember	Exhibit memory of previously learned material by recalling facts, terms, basic concepts, and answers.	arrange, define choose, identify, indicate, label, list, locate, match, memorize, name, outline, quote, read, recall, recite, recognize, repeat, reproduce, select, state
Understand	Construct meaning from instructional messages, including oral, written, and graphic communication by organizing facts and ideas comparing, translating, interpreting, giving descriptions, and stating main ideas.	categorize, classify, compare, convert, defend, describe, discuss, distinguish, estimate, explain, express, extend, give examples, generalize, illustrate, indicate, interpret, interrelate, paraphrase, predict, present, report, represent, restate, rewrite, select, show, summarize, tell, translate
Apply	Solve problems to new situations by applying acquired knowledge, facts, techniques and rules in a different way.	add, calculate, change, complete, compute, demonstrate, design, divide, dramatize, execute, grade, illustrate, implement, modify, multiply, operate, organize, practice, prepare, produce, solve, show, sketch, subtract, use
Analyse	Examine and break information into parts by identifying motives or causes. Make	breakdown, categorize, contrast, compare, criticize, debate, detect, develop, differentiate, discriminate, distinguish, experiment, identify, inspect, infer, interrelate,

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

	inferences and find evidence to support generalizations.	investigate, organize, outline, question, relate, separate, subdivide, test
Evaluate	Present and defend opinions by making judgments about information, validity of ideas, or quality of work based on a set of criteria.	attribute, argue, assess, check, compare, conclude, contrast, criticize, critique, defend, determine, examine, grade, judge, justify, measure, recommend, rank, rate, reflect, support, test
Create	Compile information together in a different way by combining elements in a new pattern or proposing alternative solutions.	Arrange, calculate, combine, compose, construct, design, develop, devise, drive, formulate, generate, hypothesize, integrate, plan. Prepare, prescribe, produce, propose, reconstruct, revise, rewrite, summarize, synthesize, transform

Table 1 - Revised Cognitive Domain in Bloom's Taxonomy

Affective domain

Though research indicates that the affective domain is “the gateway to learning”, (Pierre & Oughton, 2007), this area is often underestimated and the cognitive and psychomotor “take precedence.” The affective domain, (Markle & O’Banion, 2014), is the “least applied and least understood of the taxonomy trilogy”. First, affective learning “cuts across all learning domains, incorporating cognitive and behavioural learning in addition to exploring values and feelings” (Allen & Friedman, 2010).

The affective domain focuses on the attitudes, values, interests, and appreciation of learners. The hierarchy associated with it begins with receiving and listening to information, and extends to characterization, or internalizing values and consistently acting upon them. It focuses on allowing learners to understand what their own values are and how they have developed.

Table 2, adapted from the earliest version of the taxonomy, would give a glimpse of the complexity of this domain of learning. Almost all verbs which describe activities targeted or measured at each level of the affective domain do basically describe cognitive learning and some have psychomotor dimensions.

Affective level	Description	sample of action verbs in each Affective Domain
Attention	Being aware of or attending to something in the environment	ask, choose, describe, follow, give, hold, identify, locate, name, point to, select, sit, erect, reply
Response	Showing some new behaviours as a result of experience	answer, assist, aid, comply, conform, discuss, greet, help, label, perform, practice, present, read, recite, report, select, tell, write
Value	Showing some definite involvement or commitment	complete, demonstrate, differentiate, explain, follow, form, initiate, invite, join, justify, propose, read, report, select, share, study, work
Organization	Integrating a new value into one's general set of values, giving it some ranking among one's general priorities	adhere, alter, arrange, combine, compare, complete, defend, explain, formulate, generalize, identify, integrate, modify, order, organize, prepare, relate
Generalization	Acting consistently with the new value	act, discriminate, display, influence, listen, modify, perform, practice, propose, qualify, question, revise, serve, solve, verify

Table 2. The Affective Domain in Bloom's Taxonomy

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

3.5 Activities & Assessment in Bloom's Taxonomy

Activities and questioning are the fundamental tools for instructors. Both activities and questioning require learners to use different cognitive processes to interact with unit/lesson content. The quality of activities set, and questions asked has a direct impact on the progress that trainees make. By aligning these with Bloom's taxonomy, cognitive demands are made on trainees, which can facilitate more challenge and help ensure rapid learning.

In the following tables, question stems and sample activities for each level of Bloom's taxonomy are provided using ideas from Dalton & Smith (1986), adapting their work according to Upskilling Lab 4.0 objectives. Although these lists are not exhaustive, they do provide an excellent starting point for instructors.

Activities and Assessments are numbered to be easily referenced later in the Upskilling Lab 4.0 framework. Both tables are a collection of learning activities and assessments, each one in a different domain.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

	Learning Activities (A)	Assessments (E)
Remember Retain, recall and recognize knowledge	A1 - Flashcards A2 - Highlight key words A3 - List A4 - Memory activities A5 - Reading materials A6 - Watching presentations and videos	E1 - Clicker questions E2 - Fill-in-the blanks E3 - Label E4 - Match E5 - Multiple choice E6 - Quizzes E7 - True and false questions
Understand Translate and interpret knowledge	A11 - Case studies A12 - Concept map A13 - Demonstrations A14 - Diagrams A15 - Flowcharts A16 - Gamification A17 - Group discussions A18 - Lightboard A19 - Mind map A20 - Matrix activity A21 - Play/sketches A22 - Summarize A23 - Think-pair-share	E6 - Quizzes E14 - One-minute paper E18 - Concept map E19 - Create a summary E20 - Essay E21 - Diagrams E22 - Infographics E23 - Matrix activity E24 - Presentation E25 - Provide examples E26 - Short answers
Apply Apply knowledge to different situations	A11 - Case studies A12 - Concept map A16 - Gamification A31 - Calculate A32 - Creating examples A33 - Demonstrations A34 - Flipped classrooms A35 - Galleries walk A36 - Group work A37 - Lab experiments A38 - Map A39 - Prezi	E24 - Presentation E27 - Short answers E34 - Discussion board post E35 - E-portfolio E36 - Lab reports E38 - Problem-solving tasks E39 - Tests
Analyse Break down information to look at relationships	A11 - Case studies A12 - Concept map A44 - Compare and contrast (with charts, tables, Venn diagram) A15 - Flowcharts A45 - Discussions A46 - Graph A47 - Group investigation A48 - Report/survey A49 - Think-pair-share A50 - Review paper	E14 - One-minute paper E49 - Analysis paper E50 - Case studies E51 - Evaluation criteria E52 - Critique hypothesis, procedures E53 - Muddiest point E54 - Research paper E55 - Review paper
Evaluate Make judgements based on evidence found	A19 - Mind map A50 - Review paper A53 - Debates A54 - Journal A55 - Pros and cons list	E14 - One-minute paper E60 - Argumentative or persuasive essay E61 - Debates E62 - Discussions E63 - Presentation E64 - Provide alternative solutions E65 - Report
Create	A19 - Mind map A59 - Brainstorm A60 - Decision-making tasks A61 - Develop and describe new solutions or plans A62 - Performances	E70 - Develop criteria to evaluate product or solution E71 - Grant proposal E72 - Outline alternative solutions E73 - Research proposal

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

	A63 - Presentations A64 - Research projects A65 - Written assignment	
--	--	--

Table 3 – Activities & Assessments for Cognitive Domain

	Learning Activities (A)	Assessments (E)
Receiving Being willing to listen and be aware to receive knowledge	A6 - Watching presentations and videos A8 - Attend focus groups A9 - Listen as audience to a presentation A10 - Read articles/papers/textbooks	E8 - Feedback forms E9 - Fill-in-the-blanks E10 - Knowledge survey E11 - List E12 - Match E13 - Memory tests E14 - One-minute paper E15 - Qualitative interviews E16 - Test activities (recall and verbalize reactions) E17 - Write summary on key points of presentation
Responding Actively participating and engaging to transfer knowledge	A17 - Group discussions A24 - Active participating in class activities A25 - Brainstorm ideas A26 - Present in front of audience A27 - Problem solving activities A28 - Role-play A29 - Written assignments (essays, reports) A30 - Questionnaires	E14 - One-minute paper E28 - Answer questions E29 - Ability to follow procedures E30 - Critical questioning E31 - Feedback and peer evaluation E32 - Questionnaires E33 - Willingness to participate
Valuing Finds value and worth in one's learning and is motivated to continue	A40 - Debates A41 - Opinionated writing piece A42 - Reflection paper A43 - Self-report	E32 - Questionnaires E41 - Attendance E42 - Needfulness and carefulness (with minimal errors) of submitted work E43 - Meet deadlines E44 - Proposals of new plans E45 - Rating scale E46 - Reflection paper E47 - Report on activities E48 - Ungraded paper
Organization Integrating and comparing values, ordering them according to priorities	A51 - Analyse and contrast (with charts, tables) A52 - Concept map (report formal or informal experiences and identify skills)	E32 - Questionnaires E56 - Develop realistic aspirations E57 - Prioritize time to meet goals (hand work in on time) E58 - Focus groups E59 - Ability to solve new problems
Characterization Value that will control the outcome and behaviour	A56 - Critical reflection A57 - Group projects A58 - Self-report goals	E66 - Criteria for group projects E67 - Self-evaluation E68 - SMART goal

Table 4 - Activities & Assessments for Affective Domain

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

4 Upskilling Lab 4.0: 8 macro competences to foster collaboration between start-ups and corporations

4.1 First approach: Collaboration Management Framework

The main objective of Upskilling Lab 4.0 is to offer start up and companies a set of key skills to foster effective and efficient collaboration between them from the perspective of open innovation. The consortium adopted the perspective of Open Innovation from the SPROC approach (Strategy-Process-Resources-Organisation-Culture).

From that perspective, the consortium studied 6 real and specific cases of failure in collaboration involving start-ups and companies, in different contexts (Annex 1). According to “Innovation Management-Part 5: collaboration management” standards (CEN/TS 16555) all the cases belong to the Bilateral Collaboration type, applying four modes (out of seven) of collaboration: Gaining “exposure” to start-ups, “Trend-spotting”, Acceleration programs and Co-creation.

From this analysis, and taking into account European Union proposed frameworks to develop Digital Competences (DigComp 2.0) and Entrepreneurship (Entrecomp), 15 main skills were identified as key to success in a Collaboration Management Framework:

1. Expert data analysis
2. Advanced social selling
3. Mobile expertise
4. Multi-platform UX design
5. Network and information security
6. Creative thinking
7. Finding opportunities to help others
8. Recognising opportunities to create value
9. Quickly take advantage of opportunities
10. Involve others in value-creating activities
11. Contribute to simple value-creating activities
12. Design working methods and incentives that enable people to work together
13. Recognising what is learnt from taking part in value creating activities
14. Reflecting on own experience based on own value-creating activities and learn from it
15. Learn from monitoring and evaluation processes and establish learning processes in own organisation

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

4.2 Grouping the key skills to frame successful collaboration: 8 skill cards

Delving deep in these 15 key skills, the consortium came up, after a profound analysis based on standard CEN/TS 16555, to group them into 8 categories (Annex 2) or macro competences as follows:

- Data analysis (incorporating skills area 1)
- Value-based selling/value-creating activities (incorporating skills 2, 8, 10, 11, 13 and 14)
- Mobile expertise/Multi-platform UX design (incorporating skills 3 and 4)
- Network and information security (incorporating skills area 5)
- Creative thinking (incorporating skills area 6)
- Monitoring and evaluation processes (incorporating skills area 15)
- Collaboration (incorporating skills areas 7 and 9)
- Netiquette (necessary for all 15 identified skills areas).

From this perspective, 8 skill cards (Annex 3) were created to develop and implement them. Recognizing the fact that a variety of skills are necessary for collaboration management for open innovation in Industry 4.0, the skills cards, thus, cover the different aspects of the project: technical, innovative and managerial. They include examples for topic specific skills (such as network and information security, mobile expertise/multi-platform UX design and value-based selling) and horizontal/transversal skills (data analysis, creative thinking, collaboration, monitoring and evaluation, netiquette).

The skills cards cover for each of these macro competences the following skills aspects:

- | | | |
|---|---|-------------|
| <ul style="list-style-type: none"> 1) Technical skills – technology + legislation (IPR) – hard skills; 2) Social-emotional skills 3) Cultural responsive 4) Creative skills | } | soft skills |
|---|---|-------------|

These skill cards are elaborated for the following mastery levels:

1. **Beginners'/basic level, trainee** - no knowledge, needs training and mentoring, limited knowledge, needs help from seniors, not able to perform critical tasks without supervision, newcomer without any practical experience.
2. **Fair/intermediate** – able to perform basic tasks without supervision, has basic knowledge, has some direct experience.
3. **Proficient** – capable and experienced, demonstrated proficiency, able to work without supervision on critical tasks.
4. **Expert** – fully capable and experienced, mentoring and helping other departments and colleagues, needs no assistance to take decisions on critical tasks, demonstrated ability to lead and train others, considered and recognized as expert within the organization and consulted often.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

These skill cards can be utilized in different levels of continuous learning:

1. **Basic** – formal education; on-site or online courses, direct mentoring and supervision; practice; learning through games and role-playing.
2. **Intermediate** – formal education; on-site or online courses, direct mentoring and supervision; practice, learning through games and role-playing.
3. **Proficient** – specialized seminars and courses (both on-site and online) on specific aspects; mentoring from experts; practice; exchange with other professionals; specialized games requiring more profound knowledge and practice.
4. **Expert** – highly specialized seminars or online courses; courses on new trends or new technologies; exchange with other multidisciplinary experts.

The skills cards are designed in a way that could be user-friendly for different sets of stakeholders.

1. **Policy makers** – as a quick reference to identify specific soft skills gaps and foster development of continuous learning programmes and policies.
2. **Teachers, trainers** – as a checklist when elaborating specific content, exercises and testing to ensure the progress of their students.
3. **Start-ups** – as a checklist that will guide them through necessary skills and competences needed in building their star teams.
4. **HR specialists in companies** – a quick reference list when recruiting new staff and a helpful checklist to facilitate internal gaps to address these with development of their specific internal corporate tailor-made trainings and team building exercises.
5. **Innovation specialists/managers** – as a fast track for detection of gaps and update in skills needed for successful open innovation projects.

5 Grounding up Upskilling Lab 4.0 Activities and Assessments

As a final element of the learning framework, a mapping has been carried out between the competences models developed in the previous phases of Upskilling Lab 4.0 with the Bloom taxonomy model.

The objective has been to take advantage of the development made on the Bloom model by adapting it to the Upskilling Lab 4.0 framework so that it can be used in the future by the trainers to define objectives, activities and evaluation elements on the progress of the trainees in the development of their competences.

5.1 Equivalences between Bloom taxonomy domains and Upskilling Lab 4.0 levels

The correspondence between the competencies defined in the skill-cards and the descriptions of behaviour and verbs defined in each of the levels of Bloom's taxonomy have been analysed in both the cognitive and affective domains.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

This correspondence is shown in the next table. As it can be noticed, given the disparity between the number of levels of the two models, it has been necessary to make an adjustment so that one of the levels of expertise in Upskilling Lab 4.0 corresponds to two levels of Bloom's taxonomy.

		Bloom's Taxonomy	
		Cognitive domain	Affective domain
U p s k i l l i n g	Beginners/basic	Remember	Receiving
		Understand	Responding
	Fair/intermediate	Apply	Valuing
	Proficient	Analyse	Organization
	Expert	Evaluate	Characterization
		Create	

Table 5 – Upskilling and Bloom's Taxonomy correspondence

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



6 Applying Upskilling Lab 4.0 Activities (A) & Assessments (E)

Finally, in this section, trainees and trainees will find the correspondences between activities and the skill cards that have been developed under the Upskilling objectives.

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Beginner/basic						
Activities			Assessment			
Technology + Legislation (IPR)	A1 - Flashcards A2 - Highlight key words A5 - Reading materials A6 Watching presentations and videos A11 - Case studies A16 – Gamification A17 - Group discussions A18 - Light board A19 - Mind map A20 - Matrix activity A23 - Think-pair-share A24 - Active participating in class activities A27 - Problem solving activities A28 - Role-play	A9 - Listen as audience to a presentation A10 - Read articles/papers/text books A13 – Demonstrations A29 - Written assignments (essays, reports) A30 - Questionnaires	A3 - List A4 - Memory activities A10 - Read articles/papers/textbooks A12 - Concept map A14 - Diagrams A15 - Flowcharts A22 - Summarize	E14 - One-minute paper E15 - Qualitative interviews E18 - Concept map E20 – Essay E23 - Matrix activity E24 - Presentation E25 - Provide examples E30 - Critical questioning E31 - Feedback and peer evaluation	E8 - Feedback forms E16 - Test activities (recall and verbalize reactions) E22 – Infographics E26 - Short answers E27 - Answer questions	E1 - Clicker questions E2 - Fill-in-the blanks E3 – Label E4 – Match E5 - Multiple choice E6 – Quizzes E7 - True and false questions E9 - Fill-in-the-blanks E10 - Knowledge survey E11 - List E12 - Match E13 - Memory tests E17 - Write summary on key points of presentation E19 - Create a summary E21 – Diagrams E28 - Ability to follow procedures E31 - Questionnaires

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Social-emotional			A8 - Attend focus groups A25 - Brainstorm ideas A26 - Present in front of audience			E32 - Willingness to participate
Cultural responsive		A8 - Attend focus groups A12 - Concept map A21 - Play/sketches A25 - Brainstorm ideas A26 - Present in front of audience	A3 – List A9 - Listen as audience to a presentation A10 - Read articles/papers/textbooks			E12 - Match E16 - Test activities (recall and verbalize reactions) E17 - Write summary on key points of presentation E19 - Create a summary E32 - Willingness to participate
Creative skills			A13 - Demonstrations A14 - Diagrams			E8 - Feedback forms E21 – Diagrams E22 - Infographics E27 - Answer questions E32 - Willingness to participate

Table 6 – Upskilling Activities & Assessments for Beginner/Basic

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Fair/intermediate				
Activities		Assessment		
Technology + legislation (IPR)		A31 - Calculate A33 - Demonstrations A37 - Lab experiments A38 - Map A39 - Prezi		E35 - Lab reports E37 - Problem-solving tasks E38 - Tests E41 - Needfulness and carefulness (with minimal errors) of submitted work E43 - Proposals of new plans E44 - Rating scale E45 - Reflection paper E46 - Report on activities E47 - Ungraded paper
Social-emotional	A32 - Creating examples A34 - Flipped classrooms A40 - Debates A41 - Opinionated writing piece A42 - Reflection paper A43 - Self-report	A35 - Galleries walk A36 - Group work	E33 - Discussion board post E34 - E-portfolio E40 - Attendance E42 - Meet deadlines	E45 - Reflection paper E47 - Ungraded paper
Cultural responsive		A35 - Galleries walk A39 - Prezi		E37 - Problem-solving tasks E41 - Needfulness and carefulness (with minimal errors) of submitted work E45 - Reflection paper E46 - Report on activities
Creative skills		A33 - Demonstrations A35 - Galleries walk A36 - Group work A37 - Lab experiments A38 - Map A39 - Prezi		E35 - Lab reports E37 - Problem-solving tasks E41 - Needfulness and carefulness (with minimal errors) of submitted work E43 - Proposals of new plans

Table 7 – Upskilling Activities & Assessments for Fair/Intermediate

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



Proficient				
Activities			Assessment	
Technology + legislation (IPR)	A45 - Discussions A49 - Think-pair-share	A44 - Compare and contrast (with charts, tables, Venn diagram) A46 - Graph A47 - Group investigation A50 - Review paper A51 - Analyse and contrast (with charts, tables)	E49 - Case studies E51 - Critique hypothesis, procedures E52 - Muddiest point E53 - Research paper E54 - Review paper E57 - Focus groups	E48 - Analysis paper E50 - Evaluation criteria E57 - Prioritize time to meet goals (hand work in on time) E58 - Ability to solve new problems
Social-emotional	A52 - Concept map (report formal or informal experiences and identify skills)	A47 - Group investigation A49 - Think-pair-share A50 - Review paper		E48 - Analysis paper E55 - Develop realistic aspirations
Cultural responsive		A46 - Graph A47 - Group investigation A50 - Review paper		E55 - Develop realistic aspirations
Creative skills		A44 - Compare and contrast (with charts, tables, Venn diagram) A46 - Graph		E55 - Develop realistic aspirations E58 - Ability to solve new problems

Table 8 – Upskilling Activities & Assessments for Proficient

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.



		Expert		
		Activities	Assessment	
Technology + legislation (IPR)		A55 - Pros and cons list A64 - Research projects	E59 - Argumentative or persuasive essay E60 - Debates E61 - Discussions E62 - Presentation E63 - Provide alternative solutions E64 - Report E67 - SMART goal E71 - Outline alternative solutions E72 - Research proposal	E64 – Report E69 - Develop criteria to evaluate product or solution E70 - Grant proposal
Social-emotional	A53 – Debates A54 – Journal A56 - Critical reflection A57 - Group projects	A55 - Pros and cons list A58 - Self-report goals A59 – Brainstorm A62 - Performances		E65 - Criteria for group projects E66 - Self-evaluation
Cultural responsive	A60 - Decision-making tasks A61 - Develop and describe new solutions or plans A63 - Presentations	A55 - Pros and cons list A62 - Performances A64 - Research projects		E65 - Criteria for group projects E66 - Self-evaluation E69 - Develop criteria to evaluate product or solution
Creative skills		A58 - Self-report goals A59 – Brainstorm A62 - Performances A64 - Research projects		E64 – Report E65 - Criteria for group projects E66 - Self-evaluation

Table 9 – Upskilling Activities & Assessments for Expert

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

7 Bibliography

- (1) Bloom, B.S., Engelhart, M.D., Furst, E.J., Hill, W.H. & Krathwohl, D.R. (1956). *Taxonomy of educational objectives: The classification of educational goals. Handbook I: Cognitive domain*. New York: David McKay Company
- (2) Anderson, L.W & Krathwohl, D.R., (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Allyn and Bacon.
- (3) Gershon, M. (2015). How to use Bloom's Taxonomy in the Classroom – The Complete Guide.
- (4) Carlson, S. (2006). The sustainable university. *The Chronicle of Higher Education*, October 20.
- (5) Krathwohl, D.R. (2002). A revision of Bloom's taxonomy: An overview. *Theory into Practice (Routledge)*, 41(4), 212–218. http://dx.doi.org/10.1207/s15430421tip4104_2.
- (6) Krathwohl, D.R., Bloom, B. & Masia, B.B. (1964). *Taxonomy of educational objectives: The classification of educational goals. Handbook II: the affective domain*. New York: David McKay Company.
- (7) Pierre, E., & Oughton, J. (2007). The affective domain: undiscovered country. *Fall, 10(4)*, Retrieved Jan 18, 2016 from: <http://collegequarterly.ca/2007-vol10-num04-fall/pierre-oughton.html>
- (8) Markle, R., & Banion, T.O. (2014). Assessing affective factors to improve retention and completion. *Learning Abstracts*, 17(11). Retrieved January 8, 2015 from https://www.ets.org/s/successnavigator/pdf/learning_abstracts_markle_obanion.pdf
- (9) Shephard, K. (2008). Higher education for sustainability: seeking affective learning outcomes. *International Journal of Sustainability in Higher Education*, 9(1), 87-98. Emerald Group Publishing Limited. <http://dx.doi.org/10.1108/14676370810842201>
- (10) Simpson, E. J. (1966). The classification of educational objectives: psychomotor domain. *Illinois Journal of Home Economics*, 10(4), 110–144.
- (11) Dave, R. H., & Armstrong, R. J. (Eds.) (1975). *Developing and writing behavioural objectives*. Tucson: Educational Innovators Press.
- (12) Harrow, A.J. (1972). *A taxonomy of the psychomotor domain: a guide for developing behavioral objectives*. New York: David McKay Company.

Web References:

- DigComp: The Digital Competence Framework 2.0: <https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework>
- Entrecomp: The Entrepreneurship competence framework: <https://ec.europa.eu/jrc/en/entrecomp>
- University of Deusto Educational Model: <https://www.deusto.es/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobhea>

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

[dername1=Expires&blobheadname2=content-type&blobheadname3=MDT-Type&blobheadname4=Content-Disposition&blobheadvalue1=Thu%2C+10+Dec+2020+16%3A00%3A00+GMT&blobheadvalue2=application%2Fpdf&blobheadvalue3=abinary%3Bcharset%3DUTF-8&blobheadvalue4=inline%3Bfilename%3D%22EMUD.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1344401764356&ssbinary=true](#)

- University of Deusto Learning Model:
<https://www.deusto.es/cs/Satellite?blobcol=urldata&blobheader=application%2Fpdf&blobheadname1=Expires&blobheadname2=content-type&blobheadname3=MDT-Type&blobheadname4=Content-Disposition&blobheadvalue1=Thu%2C+10+Dec+2020+16%3A00%3A00+GMT&blobheadvalue2=application%2Fpdf&blobheadvalue3=abinary%3Bcharset%3DUTF-8&blobheadvalue4=inline%3Bfilename%3D%22MAUD+%281%29.pdf%22&blobkey=id&blobtable=MungoBlobs&blobwhere=1344401803190&ssbinary=true>
- <http://www.coun.uvic.ca/learn/program/hndouts/bloom.html>
- <http://www.fwl.org/edtech/blooms.html>
- <http://apu.edu/~bmccarty/curricula/mse592/intro/tsld006.htm>
- <http://152.30.11.86/deer/Houghton/learner/think/bloomsTaxonomy.html>
- <http://amath.colorado.edu/appm/courses/7400/1996Spr/bloom.html>
- <http://www.stedwards.edu/cte/bloomtax.htm>
- <http://quarles.unbc.edu/lsc/bloom.html>
- <http://www.wested.org/tie/dlrn/blooms.html>
- <http://www.bena.com/ewinters/bloom.html>
- <http://weber.u.washington.edu/~krumme/guides/bloom.html>

Annex 1: Collaboration Management Framework

Annex 2: Basics of the skill cards

Annex 3: 8 Skill cards

The European Commission's support for the production of this publication does not constitute an endorsement of the contents, which reflect the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein.