



ENEX Summary Report on Assessments of the Pilot Trainings

Intellectual Output 4 / A6

IFAC-CNR

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1. Introduction: ENEX project

ENEX Project aims to develop a short-cycle vocational qualification at graduate level in accordance with the European Qualifications Framework (EQF) focused on the rapidly growing area of nanotechnology applications in industry.

Nanotechnology (NT) is a strongly emerging area of research and activity, opening up new markets, and leading to new products, processes and services in almost all industrial sectors. Because of this rapid development, there is an increasing demand of particularly qualified personnel in companies engaging in NT or in related industries, as well as in technology transfer organizations operating as intermediaries between NT research and industry.

The ENEX 'Expert in Nanotechnology Exploitation' is the interface between laboratories and researchers developing NT and the industry and health sector using its developments.

Due to the interdisciplinary nature of NT and its wide range of applications, the ENEX must have a sound knowledge and understanding of the underlying NT principles, material properties and processing techniques that enable

- to draft innovative solutions based on NT for industrial product development, and
- to steer academic research in the field of NT to realistic targets that are application-oriented and market-led.

In addition, the ENEX must have competences to assess and manage the process from NT research to product innovation to take the right decisions at strategic level ('do the right things') as well as operational level ('do things right').

This project therefore has aimed to develop a sustainable platform for providing knowledge, skills and competences in the fields of nanotechnology and product innovation management in particular to key staff of NT companies or related industry, but also to researchers, intermediaries and other stakeholders of the NT research to market process.

The main target groups addressed by the project are:

1. Companies, in particular SMEs, engaging in NT or related industries, as well as relevant key staff in those industries, e.g. project managers, business development managers, Innovation Managers;
2. Post-tertiary graduates in the fields of natural sciences (physics, chemistry, biology), medicine, engineering sciences;
3. Transfer Offices / Industrial Liaison Offices of (Technical) Universities, Strategic Divisions / Exploitation Departments of Research and Technology Centres (RTCs), as well as centre managers of RTCs, individual scientists and researchers, innovation and technology transfer professionals: consultants, coaches, mentors, analysts etc.;
4. Other stakeholders: VET providers, regional development agencies, political decision makers, chambers of commerce and industry, industrial associations, foundations relating to NT, capital investors, patent attorneys etc.

2. Pilot

A key output of the project has been the development of an e-learning course merging curricula in nanotechnology and innovation management into a new interdisciplinary and innovative pedagogical concept.

Based on the lesson plans and competence profiles defined into intellectual outputs IO1 and IO2, the course has been implemented into an e-learning concept, including configuration of the e-learning platform for specific learning requirements, development of interactive learning tools, interactive exchange of knowledge using, for example, blogs or chats.

According to ECVET guidelines, the course has been structured into learning outcomes (what a learner should know, understand and be able to do on completion of a learning process), related to each of the units of competences identified in ENEX competence profile.

Version 1 of the e-learning course comprises two Parts: Part I Nanotechnology and Part II Innovation Management, subdivided into 15 Modules, as shown in Figure 1:

Part I Nanotechnology:	Part II Innovation Management:
M1 - Introduction to nanotechnology innovation	M1 - Introduction to innovation management
M2 - Nanomaterials	M2 - Technology commercialization fundamentals
M3 - Process and fabrication	M3 - Assessing the market value of (nano) technology
M4 - Characterization	M4 - Innovation marketing
M5 - Nanobiotechnology & medical applications	M5 - Intellectual property
M6 - Energy	M6 - Management of (nano) technology development project
M7 - Nano-electronics & nano-photonics	M7 - Financing of innovation management in nanotechnology
	M8 - Corporate and academic entrepreneurship

Figure 1: Structure of Version 1 of the e-learning course.

Version 1 of the e-learning course was piloted in English by more than 65 ENEX trainees distributed among the different partner regions.

Selected trainees belong to complementary target groups, in order to cover all ENEX stakeholders, and exhibit complementary background and level of prior knowledge. Each trainee was committed to attend at least one module and was asked to assess the e-learning course through an online satisfaction questionnaire, as is described in next section.

Feedback and performance of the trainees have been used to revise the individual e-learning modules and the overall platform and to implement Version 2 of the e-learning course.

3. Satisfaction Questionnaire

The satisfaction questionnaire for pilot training (see Annex 1) contained, in the first part, a list of questions that were designed to gather statistical info about the trainees (country of residence, level of education, etc.).

The second part served to assess the individual e-learning modules over different dimensions, i.e. the quality of the learning material, the quality of the optional activities, the quality of the presentation of the learning material, the quality of the Internet platform as well as the potential of the learning material to integrate the prior learning of the trainees.

In the last part of the questionnaire, the trainees were asked to state their interest in the final format of the training course and their intention to recommend the training course to others.

The questionnaire was devised using Google Forms.

4. Analysis of feedbacks

4.1: Statistical overview of the participants

Figure 2 displays the academic profiles of the trainees. 50% of the trainees held an academic degree (bachelor, master or PhD) in Natural Science, including Physics, Chemistry and Material Science. About 30% of the trainees declared competence in the fields of Economy or Finance.

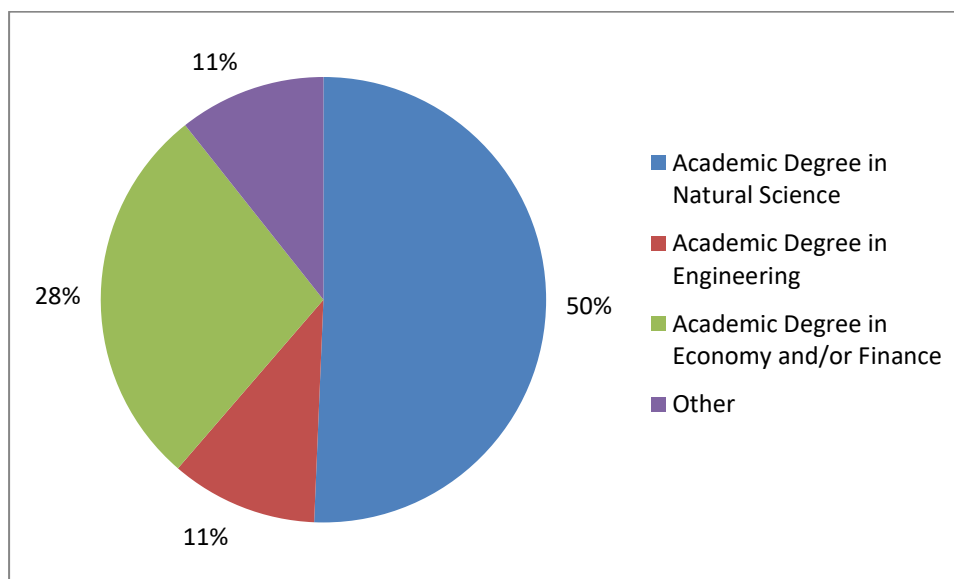


Figure 2: Academic degrees of the trainees by discipline.

Figure 3 summarizes the geographical distribution of the participants.

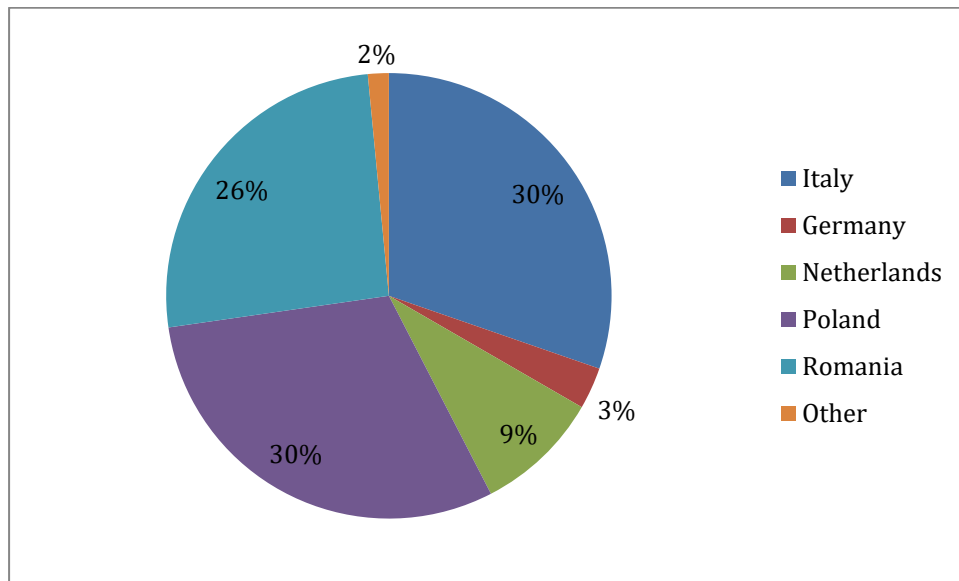


Fig 3 Geographical distribution of the participants.

All stakeholder groups, as defined in ENEX project, were involved during the pilot. Their distribution is reported in Figure 4.

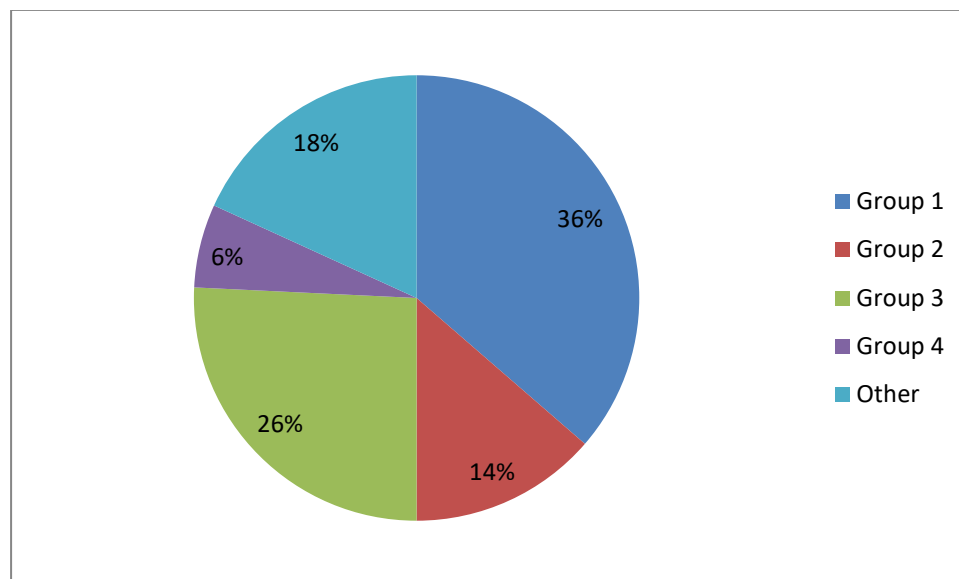


Figure 4: Stakeholder groups covered by the participants. For a definition of the groups, please refer to chapter 1: Introduction: ENEX project.t

Figure 5 displays the distribution of the individual e-learning modules that were attended and assessed by the trainees. As shown, each module was undertaken by at least three people.

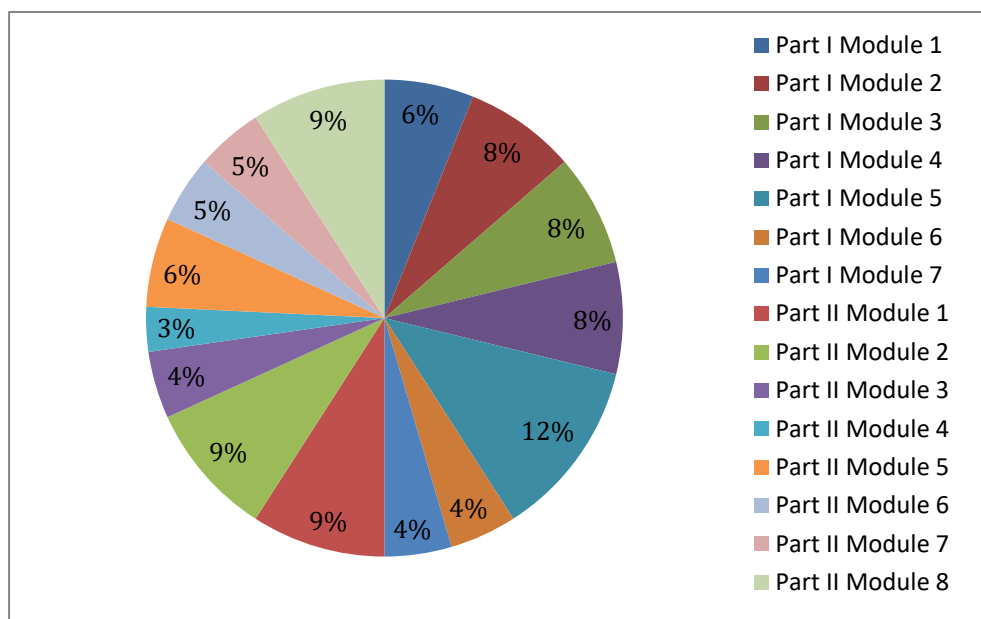


Figure 5: Distribution of e-learning modules attended and assessed by the trainees.

4.2: Quality assessment

Figure 6 provides an overview on the overall satisfaction of the trainees. In a scale from 1 (very dissatisfied) to 5 (very satisfied), the majority of the people (> 80%) answered 4 or 5.

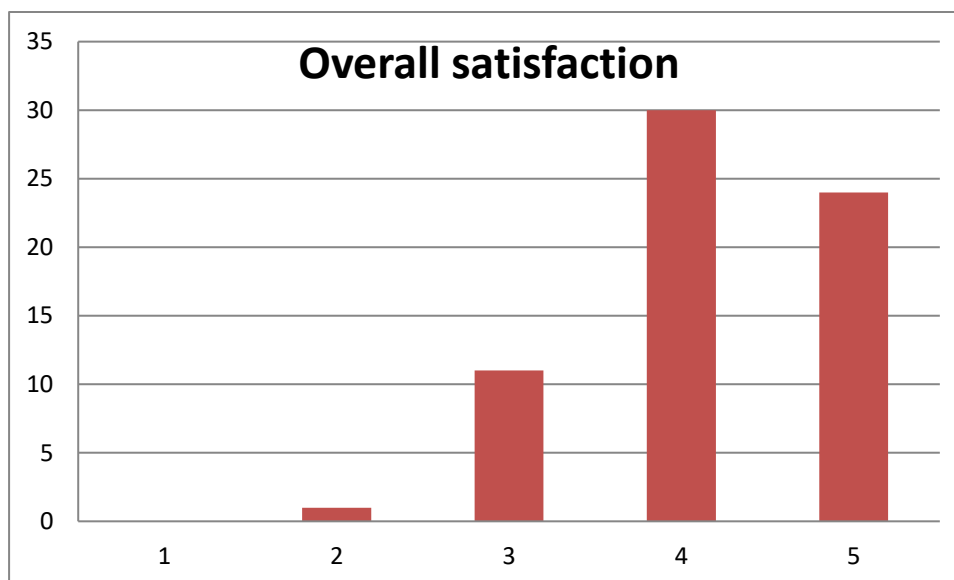


Figure 6: Overall satisfaction of the trainees for the attended module.

More in detail, we asked an assessment and comments about the quality of the contents (Figure 7), of the presentation, including relevant activities (Figure 8) and of the e-platform (Figure 9). The scale was again from 1 (very dissatisfied) to 5 (very satisfied).

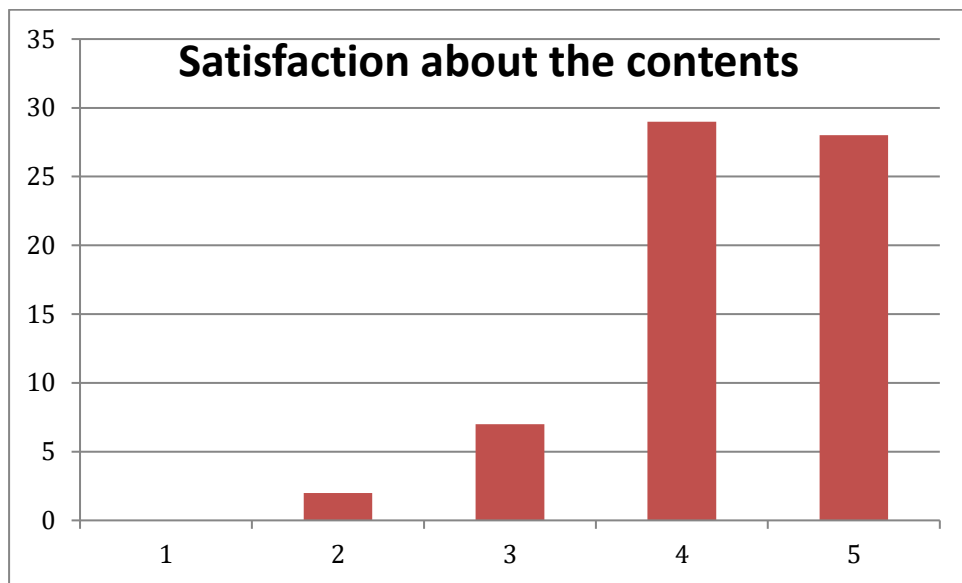


Figure 7: Satisfaction of the trainees about the quality of the contents of the attended module

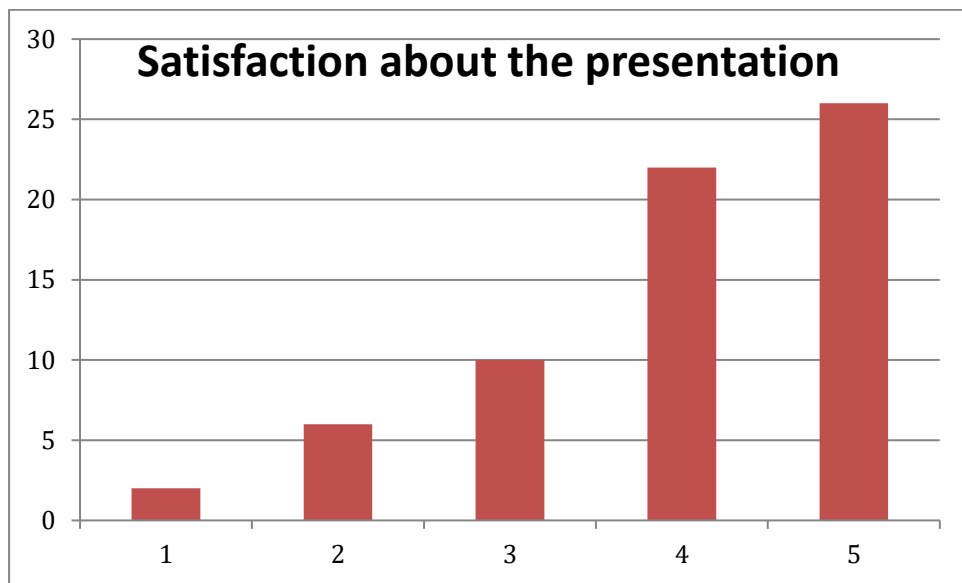


Figure 8: Satisfaction of the trainees about the quality of the presentation of the attended module

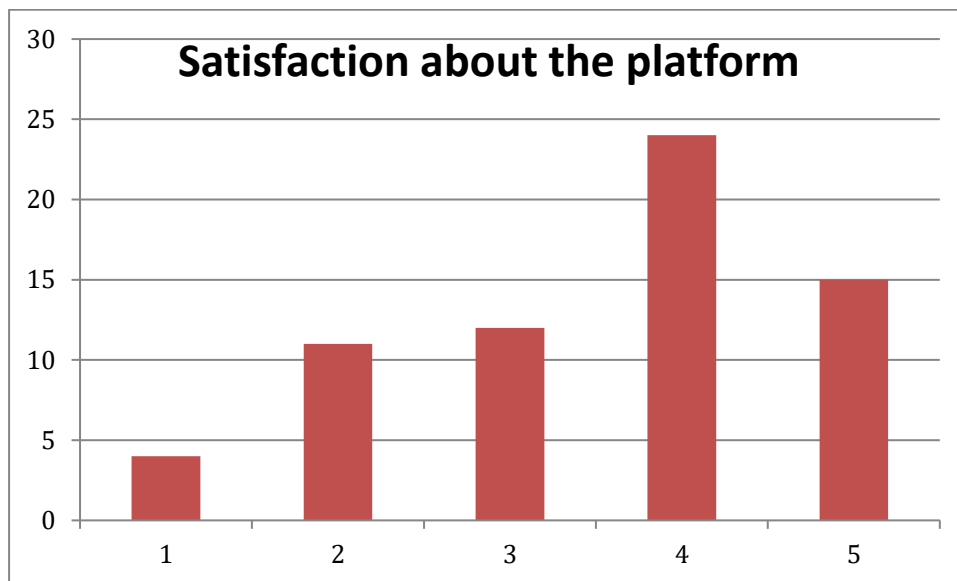


Figure 9: Satisfaction of the trainees about the quality of the e-platform

Apart from for the quality of the e-platform, most analytical comments were highly positive. We note that the learning material had already undergone substantial refinement after the first round of face-to-face pilots that were held at University of Twente and University of Lodz, whereas the e-platform had never been tested and is still under optimization.

All analytical comments were gathered and analyzed, in order to provide feedback to the authors of the learning modules and to P6 (Polytechnic University of Bucharest) for the refinement of the e-platform. The result of this analysis is reported in Annex 2 and Annex 3.

The majority of the trainees declared that the activities that were embedded in the training course enhanced their experience and self-assessment, as is summarized in Figure 10.

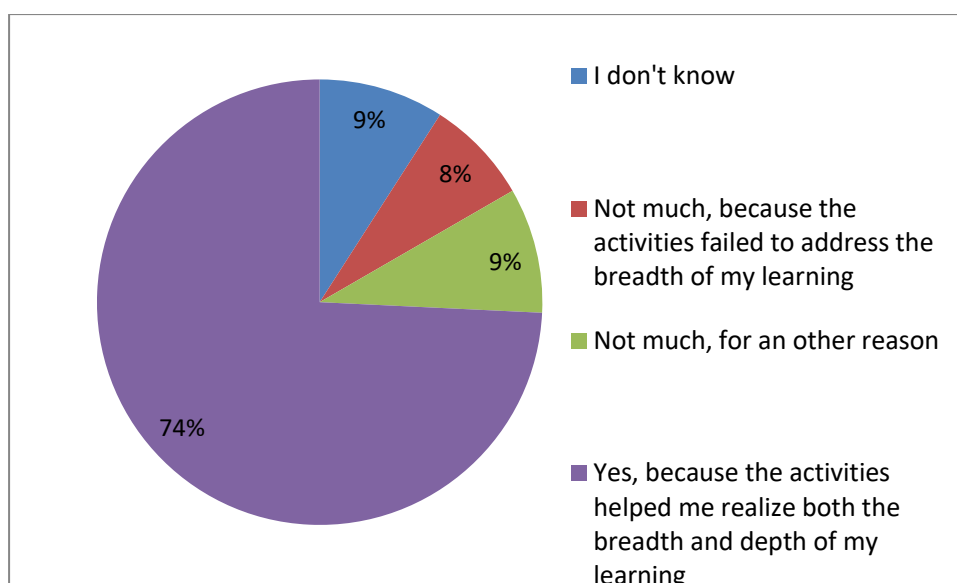


Figure 10: Worth of the optional activities, including links to external resources and formative quizzes, to integrate the experience of the trainees.

Figure 11 contains the answers of the trainees to the question on their willingness to attend the full format of the training course, in order to become an ENEX. Most trainees displayed an interest. Only few respondents were negative, mostly because the range of topics addressed by the course overlapped their prior learning. A future challenge will be to appeal to this population of respondents, by raising awareness on the value of a certification of their prior learning through ENEX procedures.

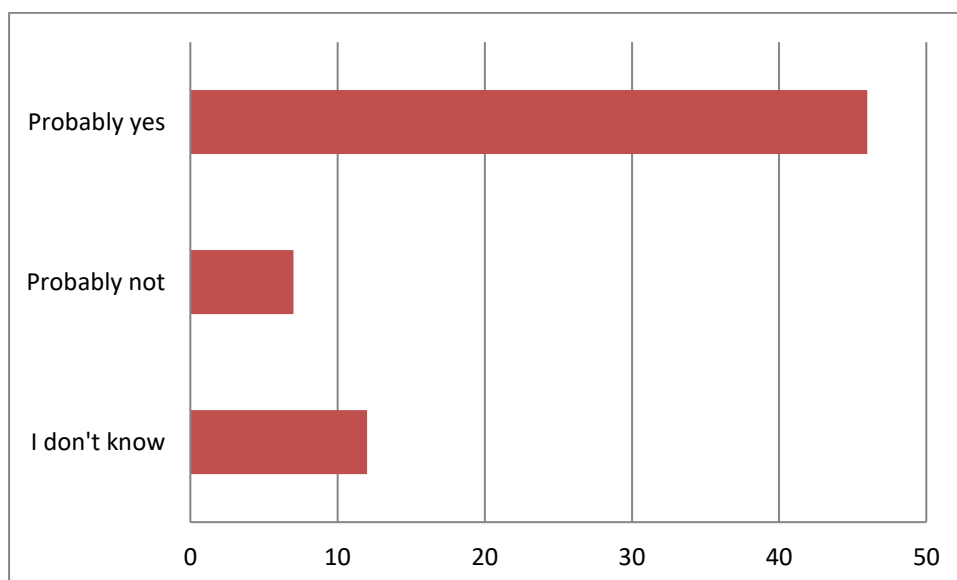


Figure 11: Intention to attend the entire course

Figure 12 contains the answers of the trainees to the question on their willingness to recommend ENEX course to others.

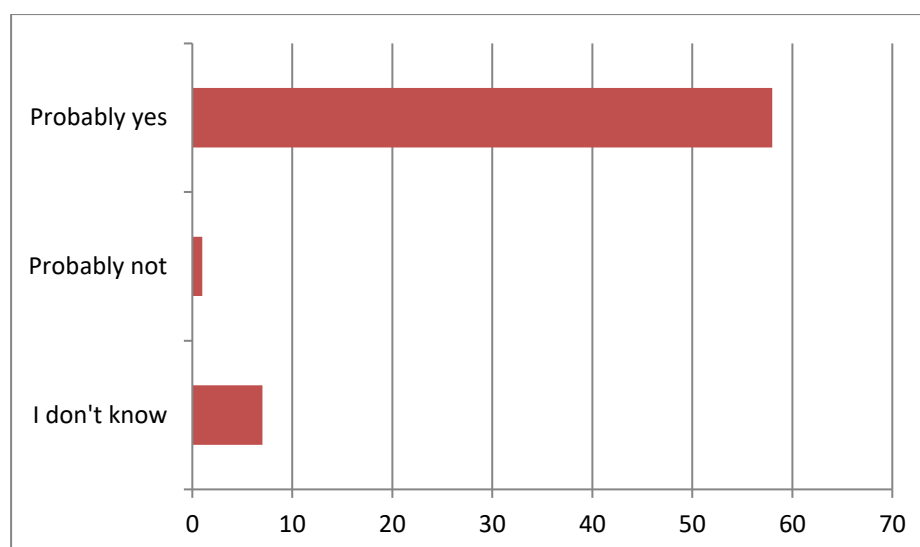


Figure 12: Intention to recommend ENEX course to others

5. Conclusion

In conclusion, most trainees that were involve in the pilot training were satisfied with the quality of the contents, the presentation, the optional activities as well as the Internet format, although the e-platform was recommended to undergo enhancement. All analytical comments were gathered and analysed, to provide feedback to the authors of the learning modules and to P6 (Polytechnic University of Bucharest) for the refinement of the e-platform. The result of this analysis is reported in Annex 2 and Annex 3.

Annex 1: The Feedback Questionnaire

ENEX Course feedback

This questionnaire is intended to gather feedback about the e-learning course for Experts in Nanotechnology Exploitation (ENEX). We appreciate your collaboration!

*Required



1. Which country are you from? *

Mark only one oval.

- ☐ Germany
☐ Italy
☐ Poland
☐ Romania
☐ Netherlands
☐ Other: _____

2. Do you have an academic degree in... *

Mark only one oval per row.

	Yes, a bachelor degree	Yes, a master degree	Yes, a PhD degree	No
... chemistry?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... physics?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... materials science?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... economy?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... finance?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
... other disciplines?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

3. If you answered other disciplines, please specify disciplines and degrees

4. Do you have professional experience in... *

Mark only one oval per row.

	Yes	No
... synthesis, characterization or exploitation of nanotechnology-based materials?	<input type="radio"/>	<input type="radio"/>
... other fields that relate to nanotechnology?	<input type="radio"/>	<input type="radio"/>
... economics or finance?	<input type="radio"/>	<input type="radio"/>
... other fields that relate to economics or finance?	<input type="radio"/>	<input type="radio"/>

5. If you answered other fields that relate to nanotechnology, please specify

6. If you answered other fields that relate to economics or finance, please specify

7. What group do you belong to? *

Mark only one oval.

- ☐ Companies, in particular SMEs, engaging in NT or related industries, as well as relevant key staff in those industries, e.g. project managers, business development managers, Innovation managers
- ☐ Post-tertiary graduates in the fields of natural sciences (physics, chemistry, biology), medicine, engineering sciences
- ☐ Transfer Offices / Industrial Liaison Offices of (Technical) Universities, Strategic Divisions / Exploitation Departments of Research and Technology Centres (RTC), as well as center managers of RTCs, individual scientists and researchers, Innovation and technology transfer professionals: consultants, coaches, mentors, analysts etc
- ☐ Other stakeholders: VET providers, regional development agencies, political decision makers, chambers of commerce and industry, industrial associations, foundations relating to NT, capital investors, patent attorneys etc
- ☐ None of them

8. Which module did you attend? *

Mark only one oval.

- ☐ Part I Module 1 - Introduction to nanotechnology innovation
- ☐ Part I Module 2 - Nanomaterials
- ☐ Part I Module 3 - Process and fabrication
- ☐ Part I Module 4 - Characterization
- ☐ Part I Module 5 - Nanobiotechnology & medical applications
- ☐ Part I Module 6 - Energy
- ☐ Part I Module 7 - Nano-electronics & nano-photonics
- ☐ Part II Module 1 - Introduction to innovation management
- ☐ Part II Module 2 - Technology commercialization fundamentals
- ☐ Part II Module 3 - Assessing the market value of (nano) technology
- ☐ Part II Module 4 - Innovation marketing
- ☐ Part II Module 5 - Intellectual property
- ☐ Part II Module 6 - Management of (nano) technology development project
- ☐ Part II Module 7 - Financing of innovation management in nanotechnology
- ☐ Part II Module 8 - Corporate and academic entrepreneurship

9. Your overall satisfaction about this module *

Mark only one oval.

	1	2	3	4	5	
Very dissatisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very satisfied

10. Your satisfaction about the quality of the contents *

Mark only one oval.

	1	2	3	4	5	
Very dissatisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very satisfied

11. Suggestions or comments about the contents

12. Your satisfaction about the quality of the presentation *

Clarity of the presentation, quality of the language, images, etc..

Mark only one oval.

	1	2	3	4	5	
Very dissatisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very satisfied

13. Suggestions or comments about the presentation

14. Your satisfaction about the quality of the e-platform *

Ease of navigation, etc..

Mark only one oval.

	1	2	3	4	5	
Very dissatisfied	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very satisfied

15. Suggestions or comments about the e-platform

16. Did the learning material advance your knowledge? *

Mark only one oval.

- ☐ Yes
- ☐ Not much, because my prior knowledge was already enough
- ☐ Not much, because my background was hardly sufficient
- ☐ Not much, because the presentation jumped too many steps
- ☐ Not much, for an other reason

17. Comments about the learning material

18. Did the activities improve your experience? *

Videos, readings, quizzes, etc.. that are intended to stimulate the breadth (how much) and depth (how deep) of learning

Mark only one oval.

- ☐ Yes, because the activities helped me realize both the breadth and depth of my learning
- ☐ Not much, because the activities failed to address the breadth of my learning
- ☐ Not much, because the activities failed to challenge the depth of my learning
- ☐ Not much, for an other reason
- ☐ I don't know

19. Comments about the activities

20. Comments on the overall design of the course

21. Would you attend the entire ENEX course? *

Tick all that apply.

- ☐ Probably yes
☐ Probably not
☐ I don't know

22. If not, why?


23. Would you recommend the ENEX course to others? *

Tick all that apply.

- ☐ Probably yes
☐ Probably not
☐ I don't know

24. If not, why?

Thank you for your time!

Powered by
 Google Forms

Annex 2: Recommendations for authors

All comments from the trainees are displayed on a per module-basis. Those highlighted in red and/or underlined require immediate attention from the authors of the learning material. The last paragraph contains an analytical summary of all comments and a list of recommendations to the authors of the learning material, in order to implement a revision.

NT.1

CONTENTS: **Too much information for a short period of time;** Good explanation of NT including modern debates and discussion about what place it holds. Touched upon how NT innovation fits in the value chain and explained well how actual value creation in practice differs with straightforward "government thinking". **It would be nice to add some examples. More examples from manufacturing would be better.** The difference between bottom-up and top-down is conceptual as in how products are developed (chemistry vs. mechanical engineering) and evaluated/tested/qualified. Manufacturing processes are also easy to show as lecturer and easy to remember as a student. **TRL levels are a good vehicle to explain conceptually how products are made but take care to state that TRL is developed for spaceflight + companies/scientists don't really recognize them as given in the definitions.** It is all a bit voluntary. This leads to massive overestimation of TRL in projects. This creates problems when one relies upon the understanding of TRL that is different between partners.

PRESENTATION: Well structured;

E-PLATFORM: When you want to come back from 1.1, for example, the list with module 1 options is not open anymore; the information on the site can be copy-pasted; the left menu is too narrow and doesn't show each subcategory fully; The slides are too small (I cannot read thumbnails and references with a big screen);

LEARNING: All the information presented is very clear; Assignments are well thought out. Some videos might be more informative as they are somewhat basic (for me), for ex. the TRL levels. Presentations are well made and clear, **although more examples may be good.**

DESIGN: It is acceptable; It is a good entry-point for students that have little to do with NT or even microtechnology. I would however doubt whether students that have had contact with NT need this course. Maybe if you expand on TRL or manufacturing a bit more it might have more value for them.

RECOMMENDED ACTIONS: Please consider to add more examples, including e.g. more links to videos; please consider to explain the origin of TRL (maybe a link to https://en.wikipedia.org/wiki/Technology_readiness_level would be informative)

NT.2

ACTIVITIES: The videos are clear and attractive;

CONTENTS: The contents is simple and; 2.6 Graphene video does not work. Parts are well connected to each other although some more integration can be beneficial. For ex. the theme of confinement and interference is relevant to atom structure but also to interactions and nanoparticles. More about this could unite the content better and inspire confidence in students that many things are reducible to a few concepts. Tough and in-depth parts such as 2.1 Atoms, 2.3 Interactions are well balanced between basics and necessary depth. Improvement can found by placing a few slides more (or splitting) the intermolecular forces part. Or some analogies like "metallic bonds = one giant molecule", polar covalent = "bit of ionic, bit of covalent", distinction between dipole, net charge, local charge (that one part of a dipole with the distance to the other part is >> than the distance to the other molecule's local charge) etc... Very good is the video 2.2 & parts 2.4 and 2.5. Enough examples present and challenging discussion thinking points can be raised. Last part on classification 2.7 may need a better explanation of the Grätzel solar cell mechanism and some way to introduce band gaps as concept. Otherwise a good part with a good explanation what the chemistry of the bulk means for the chemistry of the Nanoscale. The quiz is a bit to technical, may be OK if supplemental reading material is available with more than just slides.

PRESENTATION: The presentation is concise and easy to assimilate; In 2.5 module, one slide before the last one, there is written "...dimention..." instead of "...dimension...";

E-PLATFORM: There are several points that can be optimized, as reported in the followings. Loading the course is not fast. In the videos of sections 2.2 and 2.6 there is no possibility to watch them in full screen. None of the presentations can be visualized in full screen, thus resulting in a too small visualization of the slide and its contents. In each sections, there is a volume symbol (bottom left) that is not useful because there is no audio. The menu on the left is too long: it is important to have the presentations shown there, but only the ones of the module I am studying, not all the modules. It is not possible to scroll the menu in the horizontal bar at the top of the presentations (and this can be useful to change from the module or its section to another one). At the last slide, if you click on "Next" you are forwarded to the first slide, and this should be avoided. In the section 2.8 there is written "quiz" on top left. In the final test some of the answers are reported with a different formatting from the others; Can not zoom-in or fullscreen. Can not play the presentations independently when there are animations;

LEARNING: It's clear;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Please consider to add links to external resources for the explanation of Grätzel solar cells and band gaps or refer to module NT.6.

NT.3

CONTENTS: The link on the chapter 3.3 to "Producing gold colloidal" is not working. Videos have information which explains all the steps about the process. The contents is very brief and easy to follow. There are many examples and videos which follows the theory;

PRESENTATION: All the presentations should be watch in full screen/presentation; presentation moves fast and its not crashing / load slowly. I did not see any download button for the presentation; **Add**

references to review papers or books; Too many list and no one scheme, which in my opinion could be helpful for understanding and keep going on the lesson. On my laptop was not possible to enlarge the slides;

E-PLATFORM: The "BACK" button it is an inconvenient because you are not sent at your module back to ENEX; Navigation bar is very central, it is too much space wasted at the lateral sides of the screen. The interface is friendly, simple, without many details; Permit to extend the presentation to a full screen mode to have a bigger view;

LEARNING: Well organized, direct, focused and good enough for a first approach to the topics, especially for bachelor or master students;

DESIGN: I am just here to drop my comments (Martin also have them in e-mail). I miss a button to easily move from one section to another section (next button). Also in the test, not all answers have the same font size (Question 5 of Module 3, Part 1). Also, it would be easier to close the modules on the left and that only the module you are currently working on is open. Part 2, Module 3.2, slide 5: Text runs smoothly. Module 3.3, slide 3: text difficult to read. Is there no full-screen button? Module 3.4, slides do not have numbers. Slide with economic value assessment method... check the bullet points. Some should jump more... Why is 3.6a different in the tree than 3.5a and above? All are a follow-up activity. 3.7 and 3.8 could as well be only text instead of a presentation. Question 1: Not all answers have the same appearance. Must answer c not be called d? Now you do not fall into none of the above... Question 2: At answer a, none of the above is mentioned correctly. Funny, there is none none of the above... Why does answer b begin with basic and c with the basic? The use of the word the falls a bit out of the tone. Question 3: Again none of the above is in place b. Now it's only for answer a. Best regards, Henk-Willem;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Please consider to add more links to external resources. Whenever relevant, please consider to replace some lists with concept maps. **Martin, you should have received a Dutch original for the part in bold.**

NT.4

ACTIVITIES: As it is structured, it is not right to deepen the arguments;

PRESENTATION: The absence of a presentation mode like PowerPoint for fullscreen view. The previews of the video are too small and thus it is necessary to switch to fullscreen. The utile space designated to view to presentation could be larger. The scrolling between the slides doesn't work properly; I do not know if it's a problem on my computer, but there is no way to slide the slide or put it fullscreen, so it stays very small on the screen;

E-PLATFORM: It would be easier to navigate through the slides with a second command to come back at the previous slide, such command it could be a double-click; I would improve the navigation between the various parts of the single module. If I have to choose the last link I have to go down a lot;

LEARNING: It is very helpful that each sub-capitol is completed with videos in order to easily visualize the concepts presented; Although my background is oriented to the field of nanomaterials, it is able to favor a recap to all the techniques used in the characterization of nanomaterials;

DESIGN: Overall, the course is useful in its review (relative to your field of activity) and enlargement with regard to non-competing topics, with a basic refinement that can stimulate further personal insights by the student. Some graphic enhancements / enhancements (such as sliding options and lateral navigation ease) are advisable to improve site usability;

RECOMMENDED ACTIONS: None in particular.

NT.5

ACTIVITIES: Very good to add additional activities!

CONTENTS: The contents was very good structured, everything I understood very well; The contents are well organized and clearly exposed. However, some concept are too specific to be presented without preparation. To overcome this issue, I suggest to include information about external resources for people that would like to get a deeper understanding (e.g. books, articles etc...); When you explain the chemical structure of lipids, I suggest you to show also that of carbohydrates and proteins, with particular reference to functional groups, before going to talk about DNA; Part 5.2, slide 11: acides gras is in French => keep all content in English; C1, C2 and C3 on the same slide => it is not fully clear what they are referring to; Slide 12: "other types of biological lipids that ARE can be found in cellular membranes" => ARE should be removed; Part 5.4, slide 5: until this slide (and also later) it is not clear what a basepair is, neither how they form (pairs of AT/TA and GC/CG), also nucleotides are not explained. More explanation on this slide based on the images would help; Slide 8: Picture on top right has many abbreviations which are not explained, the image is not self-explanatory and in this form does not have an added value; Part 5.6, slide 10: explanation of picture on the top right would be good, or a link to the other picture; Slide 11: Link the image of the test tube with the image of the chip (e.g., show where the processes take place in the chip); Part 5.8, slide 3: possible to use real (not expected) number of 2016? Slide 6: 'release' => should be 'releases'; Slide 12: 'there by' => should be 'thereby';

PRESENTATION: The presentation was very interesting, the contents have very good information about everything; Some slides cannot be correctly viewed (the texts are overlapped). The presentation cannot be opened as such, thus it cannot be adjusted to the viewer's needs. There is no end button at the end of the presentation so it gets back to the beginning. In the questionnaire, answers like "none/all of the above" should be the last one, otherwise it doesn't make sense; Figures have no sources mentioned, slide numbers in each presentation would be good for taking notes;

E-PLATFORM: Everything works right, I found everything very easy; It is very uncomfortable to navigate through the course parts, e.g. the whole menu opens while you're doing one module and the page gets very long. You have to scroll down a lot to find the next material you have to attend and it gets confusing; In the overview of the course material for part I, module 5, the order of the documents is mixed: 5.5 comes after 5.6 and not after 5.4; 5.7 is missing; No button to view the presentations full screen (only F5);

LEARNING: I found interesting something I never heard about;

DESIGN: I felt good reading about all those things, for me it was a benefic experience; The materials are good, but the website fruition is really poor;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Please consider to add more links to external resources. Please consider to explain the structure of carbohydrates and proteins, if relevant, or mention external resources. Please also consider to expand on the notion of base pair or mention external resources.

NT.6

ACTIVITIES: Everything was very interactive; Which activities?

CONTENTS: Every thing is all right; In general, a more in-depth treatment of some fundamental concepts (working principle of organic and hybrid PV, general working mechanism of fuel cells) would be welcome;

PRESENTATION: It is a very good one; The videos were ok except part 6.8 which did not show. For presentaion I could only see the slides and there was no sound or narration. Maybe it is meant that way but then the information on each slide was much much more than could be digested by non-expert without any explanation;

E-PLATFORM: It is simple and handy, but the menu on the left is badly designed. One has to scroll pages to find a section. No easy way of handling the course tree;

LEARNING: I had learned about another type of energy;The videos have different depth. The slides are meant for people with at least a BS in physics or chemistry. Still they need explanation and just reading the slides does not convey the information. With only 3 questions for the whole module, it is unclear what is supposed to be learned. I expected at least several questions per presentation or video;

DESIGN: The design is very good;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Consider to add more links to external resources, in order to explain the concepts of photovoltaics and general principles of fuel cells. Please make any effort to simplify this module! Please consider to add more formative questions, including some about the videos.

NT.7

CONTENTS: Too much information for the allocated time; A lot of topics are cited, but only few examples are deepened;

PRESENTATION: In some of the slides, the bibliography text of the images is too close to the image itself, making it hard to read for the user. It can be moved a row below the image; Typing errors are present in the first part of the module; Good to use as stand alone material, but some typos included;

E-PLATFORM: I think that the e-platform is in general a good method to improve your knowledge about the provided subject; It is not immediate to pass from a lesson to the successive one; Difficult to navigate through different parts of a module;

LEARNING: Small typing mistakes inside the slides, for example, there are a lot of commas at the end of the text, instead of ending points. There are some typing mistakes inside the text (for example see the Carbon nanotubes slide inside the 7.4 module). In the modules with a video provided, the video itself is down scaled too much in comparison with the page, forcing most of the users to enter full screen in order to understand its content. In the slide preview window (outline), the slides have "---" instead of a representative title (for example, instead of the "---" text it can shown the title of the slide itself. The transition between the modules is not automated. Upon opening a PDF based module, the file opens inside the current tab, closing the ENEX interface. I think it can be opened in a new tab, leaving the option for the user to change back to the interface at any time, without closing the PDF file;

DESIGN: The overall design of the course is pretty intuitive and user-friendly;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Please double check for typos. Please consider to add more examples.

IM.1

ACTIVITIES: Yes , the activities was very useful for me;

CONTENTS: The content is good but you can try to create more slides with less information. In this moment some slides are full of information;

PRESENTATION: The contrast of the font can be changed in some slides, and you can add more pictures in contrast with your information;

E-PLATFORM: The e-platform seems to be very nice organized. I have nothing to say here;

LEARNING: I don't have nothing to say here, the material was very useful for me;

DESIGN: A very interesting idea of the design of the course, with all the external links for more information;

RECOMMENDED ACTIONS: Please consider to split some slides into more slides. Please consider to use larger fonts whenever possible as well as more graphical elements.

IM.2

ACTIVITIES: Too many activities for a small sub-module; Maybe some more quizzes or exercises at the end of sections could be useful; Too long and need more direction/guidance;

CONTENTS: Not enough relevant information; Some slides could have more information; The content has a good choice for the sequence of topics. There is however not a lot of interaction between the different

topics and knowledge/facts are hardly (re)used in each subsequent topic. Focus is on facts/notions/classification knowledge while insight and (re)productive skills are as good as absent except in some supplemental material and some exercises. The exercise sections are more informative than the presentation sections. However some of these need more guidance and stimulation placed for the benefit of students. More examples should be present in the presentations. Many parts are straight-forward thinking that does not bring new insight for the students. Assuming that the students for this programme are older and more experienced than the average college-entrant, some of the material may seem too simple and dry. How about risks? This is the main driver of success/failure in the market. A good point of view and understanding the risks involved with each stage is more important than enumerating what subparts each stage consists of. 2.2. Clear slides, maybe some more details and discussion/dilemmas/questions/provocation to exemplify the content. 2.3 Too much focus on systematization and little use of background knowledge, logical thinking or "fill-in-the-gaps" didactic methods. Models are interesting but there is no comparison between them and in general explanation about what lies behind the models. They seem like a static picture of a dynamic system. How useful is this in practice i.e. why should I adhere to this? 2.3a Exercise is OK but needs a bit more student guidance. Link to model webpage seems like a marketing expose. 2nd link leads to generic uni website. 2.4 Not really connected to 2.2 or 2.3. Content is informative though. Maybe shorten or de-dry it trough examples and connecting to experiences of students. Leave things to the imagination. More links to text would be preferable to slides. 2.4a OK but maybe a template would be better. 2.5. In depth on the issues of strategy is a big +. Knowledge transfer and logical thinking are encouraged more than the rest of the sections. However, vague phrases like "determining the strategic direction of analytical thinking" should be avoided or explained with an asterisk on a footnote (for example). 2.5a Paper on biotech is excellent: informative, challenging and logical. The rest of the papers are very long and would take far more than 10h to read. One of them is a complete thesis! Please shorten or extract text/points from them. 2.7. Are these references for the presentations or is this required reading material? What is the use of it? 2.8 Use Quiz with one "z" only. It was informative and surprisingly interesting.

PRESENTATION: Slides should have a page numbering that indicates the total number of slides (for example "page 1 of 10"); Too much focus on bullet-point delivery. Too dry and looks like there is very little effort done to exemplify, gain insight or constructively add knowledge to students. This makes the presentations dry and not of much use without the accompanying talk. Focus on enumeration and classification is too much. Students must be able to draw own conclusions for simple classification things or otherwise nothing will be remembered. Supplemental material is interesting but too long.

E-PLATFORM: Numbering of modules should be more clear (e.g. I.7.1, II.5.3); I've tested the platform with 3 most popular browsers (Chrome, Firefox and Opera) and it works very well. Sometimes page scrolling using keyboard arrows doesn't work, furthermore the ability of putting the slides fullscreen could be really useful; Can not zoom-in on presentations. Can not get an overview page or links to every subsequent part (must get back). Sidebar is too small;

LEARNING: Provided information is satisfactory; Nothing in particular;

DESIGN: Can be improved probably; The section of the course that I've tested is really clear and it seems to be completed; The design is clear and friendly looking;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Please make an effort to emphasize the logical flow from slide to slide and consider to make more use of concept maps rather than lists. Please consider to add more examples and/or links to external resources and verify the relevance and aptness of the current ones (e.g. although access to external resources is optional, a complete thesis is maybe too much). Please also consider to introduce the notion of risk, if relevant, or refer to another module where this concept may be described.

IM.3

ACTIVITIES: I suggest to increase the activities;

PRESENTATION: The presentations are almost all with bullet points, there are few diagrams and images, as a consequence it is a bit hard to follow;

E-PLATFORM: The e-platform is inadequate and unsuitable and not user friendly. There is no full screen mode, there is no way to enlarge, I have a Macbook Pro 15" part of the diagram are not readable at all. The menu on the left is inadequate because it is narrow and long and not user friendly. Misleading audio logo;

LEARNING: The learning material is very suitable for the course;

RECOMMENDED ACTIONS: Please make an effort to replace some lists with concept maps and/or graphical elements, as relevant. Please consider to add more examples and/or links to external resources

IM.4

ACTIVITIES: Too many activities to be realized in such a small time; Adequate;

CONTENTS: Interesting material, but can be improved;

PRESENTATION: Some language mistakes; some images are not clear; No full screen options, slides crowded, too small characters and fonts not well readable;

E-PLATFORM: The possibility of view the lectures full screen; Very difficult to navigate. Left vertical bar extremely long to scroll, horizontal bar not navigable;

LEARNING: Nice and interesting;

DESIGN: minimalist design which is quite good, plus the fact that there are a lot of images makes it easy to use; It is a pity that the low quality of presentation is damaging the great content;

RECOMMENDED ACTIONS: Please double-check for typos. Please try to use larger fonts and eventually split some slides into more slides, as needed.

IM.5

ACTIVITIES: The activities are basically additional reading material and websites. **Additional videos with examples as in the other modules would be nice;**

CONTENTS: In general all important information is mentioned in the presentation. **Some small additional points and typos: Section 5.1, slide 3: (should know about) => closed brackets after 'should'. Section 5.2, slide 2: in the 3rd bullet point, no comma after 'promote'. Section 5.3, slide 5: what is meant with 'remaining possibilities'? This is not clear to me. Section 5.4, slide 5: 'patent procedure' does not seem to be the right title of the slide. Section 5.5: most slides only contain links and a picture of the website, however it is not really clear which information can be found on the website and why this would be useful;**

PRESENTATION: In general, **all slides only contain text, which is quite boring to study.** I understand that the nature of the topic is quite theoretical, **but still some pictures, animations or examples would already help quite a lot.** For example in section 5.7, slide 5, an example from Coca Cola is given which makes the message clearer;

RECOMMENDED ACTIONS: Please double check and fix the items that are underlined. Please double-check for typos. Please try to add one video and more graphical elements.

IM.6

CONTENTS: Sufficient information and the extra links are very useful;

DESIGN: The course has a friendly interface that makes it easy to follow and acquire the information;

RECOMMENDED ACTIONS: None in particular.

IM.7

RECOMMENDED ACTIONS: None in particular.

IM.8

ACTIVITIES: Their presentation could be on a separate browser page (if possible);

CONTENTS: As a general comment, **the content is not always clearly contextualized and the bulleted list form is used too much frequently; each point of the list is not always explained and its role and importance are not clearly deducible from the slide context.** Therefore, the slide reading and comprehension is somewhat difficult, unless for an already expert reader. In addition, **8.7 could be further enlarged with additional content; the Glossary as well could be (greatly) enlarged with many additional terms.** In some cases the "follow-up" section seems to be more a deepening section than a follow-up, so that it could be fruitfully integrated in the slides, whose comprehension would be much facilitated;

PRESENTATION: In terms of readability, the slide "normal" dimensions seem to be too small, so that in many cases the text and/or the box/figure captions need to be greatly enlarged to be clearly read;

E-PLATFORM: Navigation could be improved. The possibility of navigating in between the various sections (e.g. 8.1, 8.2, etc.) with a "button" close to the slide window would also aid. **Figures and/or links could be included in many slides, where they are currently absent;**

LEARNING: The learning material improved my knowledge but it should be improved, as it was not an "easy-learning" process due also to the way the concepts and content are now delivered;

DESIGN: The course has a good potential, but to exploit it and make it even greater some work should be done;

RECOMMENDED ACTIONS: Please make an effort to replace some lists with concept maps and/or graphical elements and/or use more links to external resources. Please double-check and integrate the glossary, as relevant.

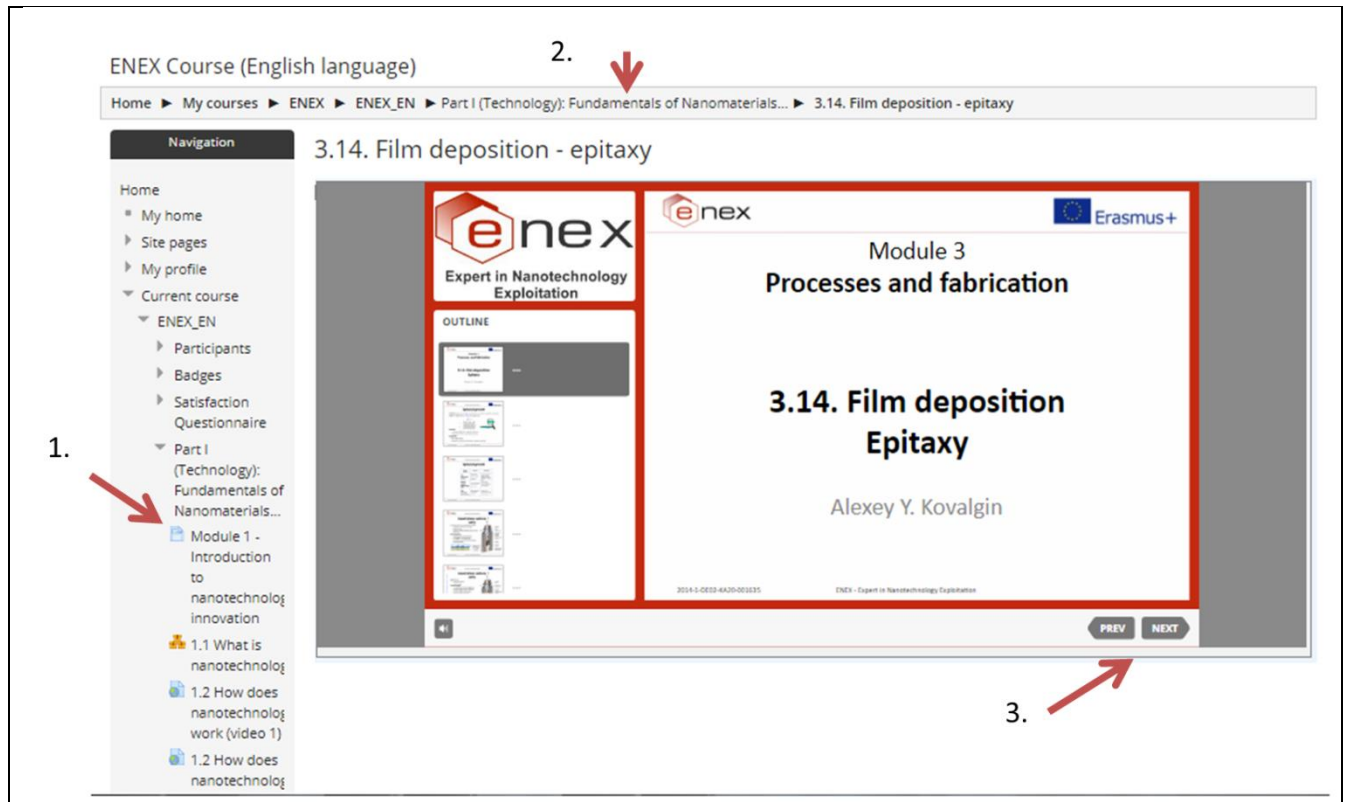
Annex 3: Recommendations for platform improvement

Main actions to improve the platform:

Full-screen option for slide presentation. For some laptop users the option ctrl+ did not work. Some did not even know about this possibility. So, if it is impossible to implement a real full-screen option, please at least add one sentence in the instructions to recommend the ctrl+ option

Menu Most of the trainees complained about the menu. One possibility would be to add more menu levels, at least at the level of the module (now it is limited to the level of the part). Referring at the arrows in the following screenshot:

- 1) Could it be possible to open/close the list of contents at the level of the module rather than the part?. It would reduce the length of the menu (many students complained about much too long scroll down)
- 2) Same problems with horizontal menu: if I'm looking at presentation 3.14, I should easily come back to a menu for Module 3 rather than Part I
- 3) When arriving at the last slide, clicking the button next sends me back to the first slide of the same presentation, instead it should either link to the following presentation/activity or to a menu for the module
- 4) We suggest that the previews of the slides be either removed (in order to optimize the size of the slides) or enabled for navigation



Below is a complete list of comments that we have collected:

- Please organize folders hierarchically: parts> modules> units, in order to simplify the menus
- Please allow navigation among units of the same module
- Please allow navigation among the slides of the same presentation
- In the preview, check the slide titles. Please allow preview usage for navigation
- In the left menu, please show only the units of the same module
- Please enable the menu at the top
- At the end of the slides, return to the menu of the module, rather than the beginning of the slides
- Harmonize and verify the order of menu items
- Please make any effort to optimize the size of the slides and / or provide relevant instructions!
- Please allow full screen options for videos and / or open videos in a new window
- Open pdfs in a new window
- Explain that activities and access to external resources is optional and will not undergo assessment!
- Delete the slide volume button
- Harmonize the format of questions (font size, punctuation, etc.)
- Verify that videos work!