1. OVERVIEW OF THE ACTIVITIES AND ACHIEVEMENTS

Outcomes and results are described below by the tangible products R_1, R_2, R_3 and R_4, their applications during the project and by their analyses, as follows:

R_1. The Virtual EMS Factory, the virtualized, web-based version of the equipment, their parameters and operation principles, and the processes, which are now used in a typical Electronics Manufacturing Service Factory. The **Virtual EMS Factory** was implemented and put to use at the beginning of the project by establishing a direct link to the ETT-VLAB website (www.ett.bme.hu/vlab/) from the www.elect2eat.eu website of the project and the ELECT2EAT training system. In this way the coverage of the Virtual EMS Factory was extended into the wide area of electronics technology, which is larger than assembling. The **project website** became the most important communication channel between the ELECT2EAT training system and the users, as well as between the system and the project partners. The domain name of elect2eat.eu was purchased for additional three year to ensure the accessibility of the **EAT e-learning program with three modules (PCB, DfM, and AIT)** as well as the **Virtual EMS Factory** after the completion of the project.

R_2. EAT e-learning program with the most important topics of **Electronics Assembling Technology** including Components and Printed Circuit Boards (**PCB**), Design for Manufacturing (**DfM**) and CAD, and Assembling & Test Technologies (**AIT**) modules. The system is separated into 17 chapters, from which 4, 5 and 8 belong to the PCB, DfM and AIT module, respectively. Each chapter contains **Elementary Teaching Entities** (ETEs) with 4-9 slides. Each ETE is a specific web-cast with free navigation possibility, and access to more written and oral explanations, movies and videos, a photo library, self-assessment possibility, etc.

The 3 modules of the system consist of altogether 50 ETEs with more than 300 slides and access to ca a thousand of photos, movies and videos. Written and oral explanations belong to each slide, in all the 4 languages (English, Hungarian, Romanian and Slovak), so altogether there are ca 1200 slides, 1200 text files and 1200 audio files in the system.10-15 photos, 6-8 videos and movies, 10-12 definitions of the definition matching quiz, 10-12 pictures of the picture matching quiz, and 6-8 Internet links belong to each ETE. The visual items (pictures, videos and movies) are in their original (usually English) language; however, the titles of all items as well as the quizzes have been created on all the four languages of the project.

Printable form **User Manual** of the EAT e-learning program was also edited, issued and distributed in all the four project languages.

R_3. EAT Certified Assessment Option was planned to use the self-assessment tools of '**definition matching quiz**' and '**picture matching quiz**' of the e-learning program to examine the knowledge of the trainee, who would like to acquire a certificate of the successful fulfillment of the training. The self-assessment option was completed, it is available for all users of the EAT e-learning program. Experiences showed, however, that the self-assessment process should be surpassed.

For the Train-the-Trainers courses, which were provided altogether 7 occasions in the 3 countries, a more **complex certification process** was developed by the Certifying Committee, which was established for this aim, The Certifying Committee is chaired by an independent (not belonging to the project) professor of UPB Bucharest, and committee members are professors from the three countries of the project. The certification process has three parts, namely (1) the fulfillment of the quizzes; (2) the trial lecturing and consulting of a part of the course by using the e-learning system; and (3) answer questions in writing. For the successful completion of the course and the certification process, the participant is awarded by a certificate signed by Chair and the Members of the Committee.

Moreover, according to the reviewer's advice, an officially acknowledged **Life-Long Learning module was created and obtained accreditation** from the Hungarian authorities. The curriculum of the course also includes a certification process similar to the above one. Although, possessing the accreditation is not a

proviso for running the adult training activity or the implementation of the e-learning program, yet with the expert approval of the content, the institution may ensure the uniform high professional level during the approved period of the accreditation. Furthermore: the sustainability of Elect2eat project outcome will be guaranteed in this way.

R_4. Statistics of indicators and impact factors is a report on the continuous monitoring of the progress of the innovation transfer and the application of the products. Indicators were used to get measurable results on the impact of the e-learning system. **The report** is compiled from feedbacks and interviews with people concerned. Feedbacks were provided by filling out questionnaires, which included questions concerning the training, its precedents, contents, the methods, the quality of the material, that of the slides, usability etc. The overall feedback of course participants was positive, the lower marks obtained for some questions and especially a few remarks provided great help for the continuous improvement of the course contents as well as the presentation methods during the second year of the project.
Finally, a general strategy was planned and some measures were taken **to ensure sustainability of the results** beyond the project life. From these, the transfer & receipt the accreditation of the LLL module and the application for projects sponsored by the Structural Funds and the SEE initiative of the EC are worth mentioning.

2.1 Result/Product R_1: Virtual EMS Factory – the Virtual Electronics Manufacturing Service Factory

Description of the permission for use

The Virtual EMS Factory is based on the ETT-VLAB, the Electronics Packaging Virtual Laboratory of the Department of Electronics Technology (ETT) at the Budapest University of technology and Economics (BME). The ETT-VLAB originally was developed for free educational use sponsored by the IEEE-CPMT Society and the NSF (National Science Foundation of the USA) through the Packaging research Center of GeorgiaTech. Later on, the members of ETT completed the VLAB by adding new ideas and principles to present processes and equipment using animations mostly visualized by Macromedia Flash.

Since its launching in 2000, the Department has been ensured free access to VLAB through the Internet; however, the animations have been protected against modification and downloading. The Virtual EMS Factory is an extension of ETT-VLAB, providing a special access to the same presentation of process principles and equipment operations by arranging the equipment to such a virtual layout, as they are used in a real factory. Similarly to ETT-VLAB, the access to the Virtual EMS Factory is totally free, however, through the Internet only. ETT does not intend to distribute these e-learning materials on CD-ROM or in printed format, which latter otherwise would be completely senseless. Therefore the Internet access and the Internet based use of the Virtual EMS Factory do not need any kind of permission.

Description how the result has been transferred

The Virtual EMS Factory is an extension of the freely accessible ETT-VLAB. It provides a special access to the same presentation of process and equipment operation principles of VLAB by arranging the equipment to such a virtual layout, as they are used in a real factory. In addition, starting the learning process by visiting the Virtual Factory, from place to place links are offered to the visitor to continue his or her study by entering the virtual laboratories of ETT-VLAB, or by learning the relevant ETEs (Elementary Teaching Entities) of the Electronics Assembling Technology E-learning System. The latter has the special advantage that provides written and oral explanations of the processes in four different languages, in English, Hungarian, Romanian and Slovak.

Title of result	**Virtual EMS Factory** – the Virtual Electronics Manufacturing Service Factory
Product Type	website
Marketing Text	Accessible through the elect2eat.eu website. The Virtual EMS Factory is an extension of the freely accessible ETT-VLAB. It provides a special access to the same presentation of process and equipment operation principles of VLAB by arranging the equipment to such a virtual layout, as they are used in a real factory. In addition, starting the learning process by visiting the Virtual Factory, from place to place links are offered to the visitor to continue his or her study by entering the virtual laboratories of ETT-VLAB.
Description	Accessible through the elect2eat.eu website. The Virtual EMS Factory is based on the ETT-VLAB, the Electronics Packaging Virtual Laboratory of the Department of Electronics Technology (ETT) at the Budapest University of technology and Economics (BME). ETT completed the VLAB by adding new ideas and principles to present processes and equipment using animations mostly visualized by Macromedia Flash. Since its launching in 2000, the Department has been ensured free access to VLAB through the Internet; however, the animations have been protected against modification and downloading. The access to the Virtual EMS Factory is free, however, through the Internet only.
Target group	All people who seek for jobs; employees and unemployed professionals, entrepreneurs, distributors, trainees and teachers of vocational education schools; institutions, associations, bodies of LLL, etc.
Result	Virtual EMS Factory – the Virtual Electronics Manufacturing Service Factory. Available at the elect2eat.eu, the access is free.
Area of Application	To be acquainted with EMS Factories – the Electronics Manufacturing Service Factories
Homepage	elect2eat.eu
Product Language	English

Type of evaluation and testing

Results R_1, R_2 and mostly R_3 have similar Internet based feature, their evaluation were carried out in the same testing procedure, as follows:

Demonstration days were organized for an audience of general interest, and trainings were provided for both the primary and secondary target groups. The participants' opinion gave feedback for improving the contents and the methodology, in the following ways:

- The activity and the visible satisfaction or discontentment of the participants especially of the primary target group gave very good indication where and how to improve the quality.
- Questionnaire was developed and had it filled up by the participants to get more exact feedback and measurable indicators on the usability of the material. In the questionnaires the participants were asked how satisfied they were with the aims of the training, the amount of the contact lessons and the knowledge they received during the course, whether the explanations, tasks and exercises helped their learning, if they liked the method of independent studying, etc.The evaluation of the questionnaires played active part in the quality management of the project.

- Threefold assessment method was developed, which included trial teaching (of the members of primary target group only), on-line quizzes, written tests. The results of the assessment and the satisfaction with the certification process gave also useful feedback.

According to the three types of evaluation, the methods had also three types, respectively as follows:

- The level of activity and the visible satisfaction were estimated by talking to and discussing with the participants. The members of the primary target group were mostly qualified adults: active teachers, trainers, industrial engineers, who were very good partners to freely tell us their helping opinions.
- The questionnaires provided measurable indicators for the improvements.
- The results of the assessment indicated where to improve the content.

Findings, conclusions and lessons of evaluation and testing.

In general, the participants were quite satisfied with all parts of the e-learning material.

In particular regarding R_1, they enjoyed very much the application of the Virtual Factory to get more realistic impressions about the manufacturing process, and obtain good knowledge for the practical applications of the materials, physical and chemical principles.

Partners involved

Carrying out the transfer as providing partners: BME, UPB-CETTI, TUKE

Receiving and applying the transferred e-learning content: DRKK, ERAK, ARIES, SPSE

Delivering the courses as trials for the primary target groups: DRKK, ERAK, ARIES, SPSE with the help of BME, UPB-CETTI, TUKE

Delivering and helping to provide the courses for the secondary target groups: DRKK, ERAK, SPSE