APPLICATION OF LCA MOOC AS A DECISION SUPPORT TOOL FOR TRANSPORT SECTOR

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Abstract

The main results of the international project "Virtual Open Course of Automotive Life Cycle Assessment" aLIFEca was developing LCA MOOC (life cycle assessment massive open online course) for transport sector. The LCA MOOC included results of scientific research of life cycle assessment and environmental footprints of vehicles and transport fuels like: conventionally powered vehicles, battery electric vehicles and fuel cell electric vehicles. LCA MOOC is a decision support tool for the needs of sustainable transport management, taking into account the life cycle approach

Keywords: life cycle assessment, automotive, massive open online course

1. INTRODUCTION

Environmental performance for the automotive industry is becoming increasingly important. It is therefore necessary to take into account the environmental impact of the full life cycle of a vehicle, based on a life cycle assessment (LCA), which can identify the most important types of impact categories. To understand environmental impacts of vehicle life cycle it has to be done LCA. Life cycle assessment (LCA) is the most suitable analytical method for the analysis of the life cycle of the vehicle and fuel, which allows the identification and assessment of the environmental impact of individual processes, technologies, materials and energy consumed. LCA is a standardised according to ISO 14040 for assessment of environmental impacts over the entire life cycle. The concept of LCA cover four main stages: goal and scope of analysis, inventory, stage of impact assessment and interpretation [1-4]. The main goal of the paper is to presented a massive open online course (MOOC), which was designed for the needs of sustainable management of the developing automotive industry in the face of challenges related to green mobility, taking into account life cycle approach.

2. MOOC CONCEPT FOR THE AUTOMOTIVE INDUSTRY

MOOC courses enable students, teachers and employees of companies that are certified by universities to acquire knowledge and skills. MOOCs are free remote courses that are open to the public. They are developed by universities from various countries. MOOCs are developing very rapidly, and universities, based on the results of their research, present in MOOCs important concepts and issues from various sciences and disciplines [5]. MOOCs represent innovative teaching and learning in their own nature, conducted online, are aimed at unlimited participation worldwide and open access via the Internet. MOOCs offer free and open classes to anyone who registers, regardless of skin color, religion, age, gender, health, education or qualifications. The MOOC is open to everyone.

The aim of the "Virtual Open Course of Automotive Life Cycle Assessment" project is to develop a highly specialized course in the field of life cycle assessment (LCA) in the automotive industry, which takes the form of massive open online courses (MOOCs) [6]. The project focuses on MOOCs with a certification framework and practical examples, covering the area of sustainable approaches in the automotive industry to enhance

the quality of lifelong learning opportunities and contribute to the transformation towards a Digital Europe. The aLIFEca MOOC is developed by the following universities and research institutes: The Silesian Technical University, Newton University in the Czech Republic, University of Žilina in Slovakia, VSB-Technical University of Ostrava in the Czech Republic, Spin 360 in Italy and Scoveco in Slovakia.

The developed aLIFEca MOOC is supported by international associations such as the Automotive Skills Alliance (ASA) and the European Automotive Manufacturers' Association (ACEA). The MOOC reflects the specific needs for cutting-edge skills and the specific requirements for green mobility in the context of the European Union's green strategy and the European Green Deal agenda. The aLIFEca MOOC is intended for everyone interested in LCA, automotive and its transfer to green technologies. It is especially aimed at university or high school students who present future pro-ecological employees in the automotive industry. The aLIFEca MOOC is useful for managers and engineers dealing with sustainability and product development. The course is structured and tailored to the needs of a future career in green automotive. The course was prepared based on the requirements of the automotive industry labor market changing towards green mobility and reflects the industry's requirements for employees. The aLIFEca MOOC stems from the demands of today's automotive industry for sustainability-related job roles. The aLIFEca MOOC is divided into 5 parts, shown in Fig. 1.

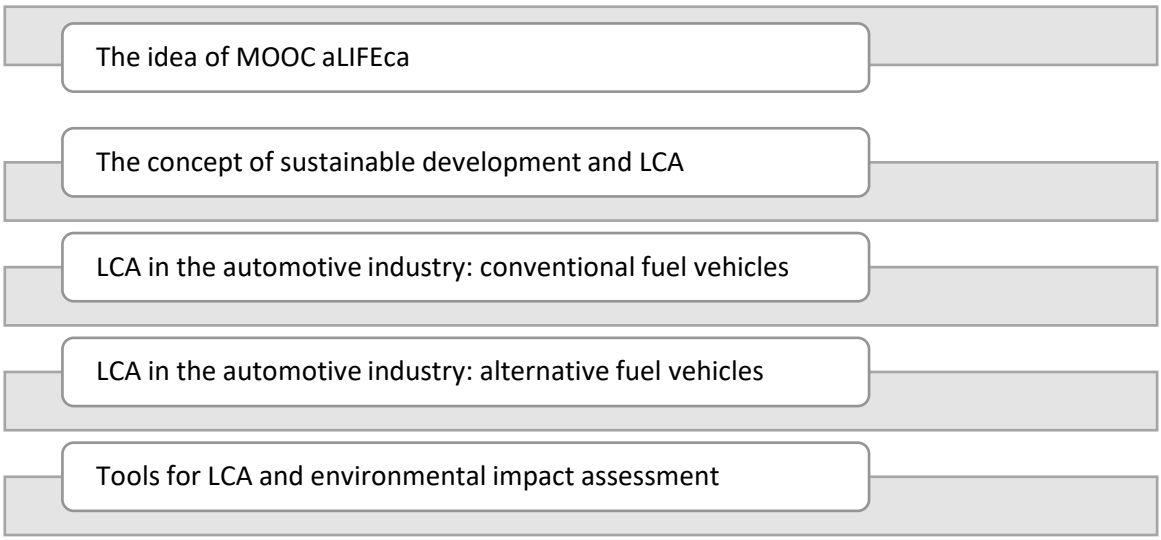

Figure 1 Elements within the aLIFEca MOOC

Each part of the aLIFEca MOOC contains both a theoretical part and the results of scientific research by the course authors. Upon completion of an aLIFEca MOOC, a certificate or digital badge is offered as recognition of skill level achievement. Fig. 2 shows the area of scientific and research work that was carried out to develop the aLIFEca MOOC course.

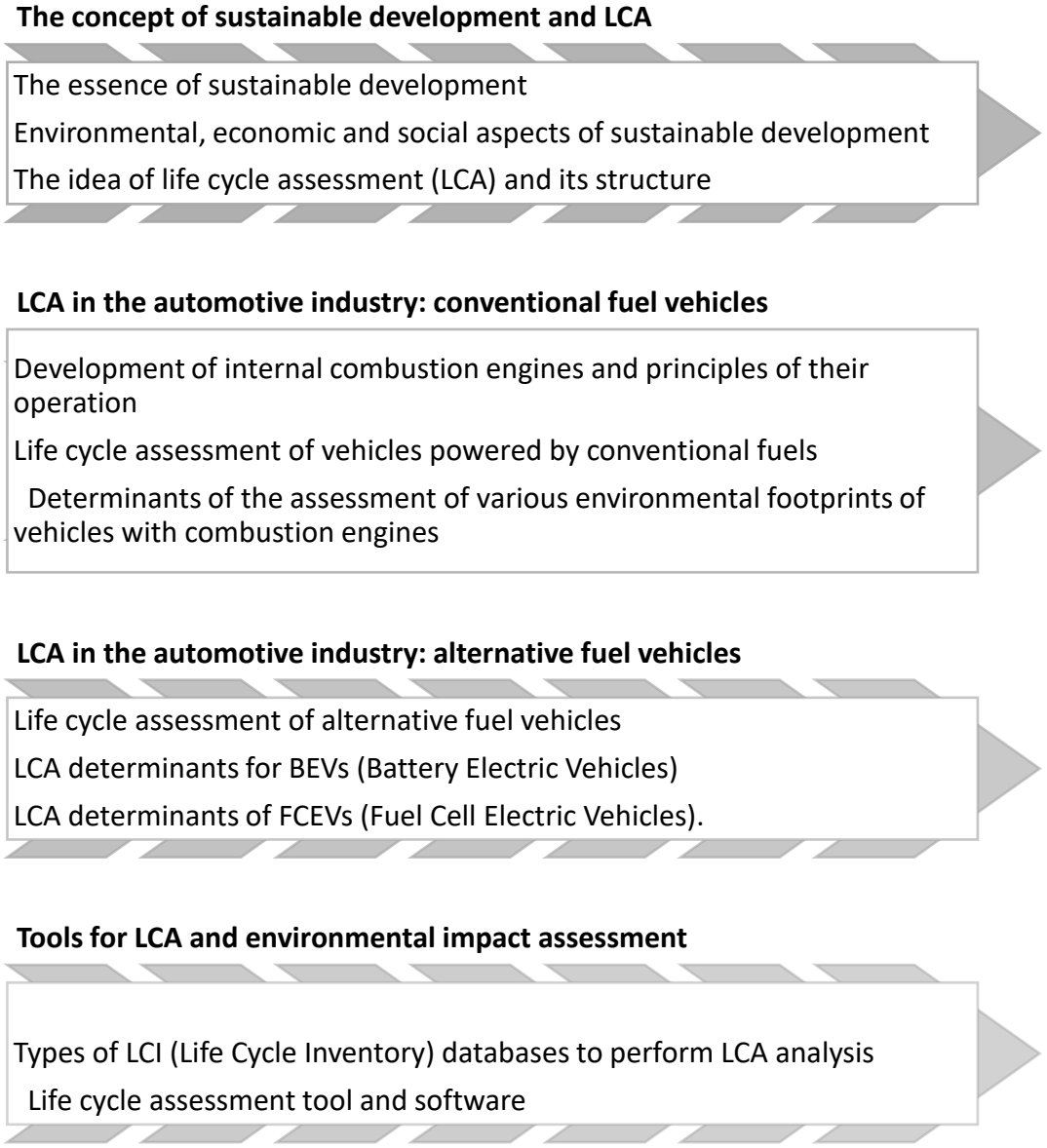

Figure 2 Scientific and research areas within the aLIFEca MOOC

MOOC aLIFEca is the first online course that allows you to gain knowledge about life cycle assessment of vehicles using conventional and alternative fuels. The aLIFEca MOOC contains the results of scientific research conducted at several universities on vehicle life cycle assessment and a mathematical model for calculating the environmental footprint of electric vehicles. The course allows you to gain knowledge about many important concepts related to green mobility, taking into account the life cycle approach (Fig. 3).

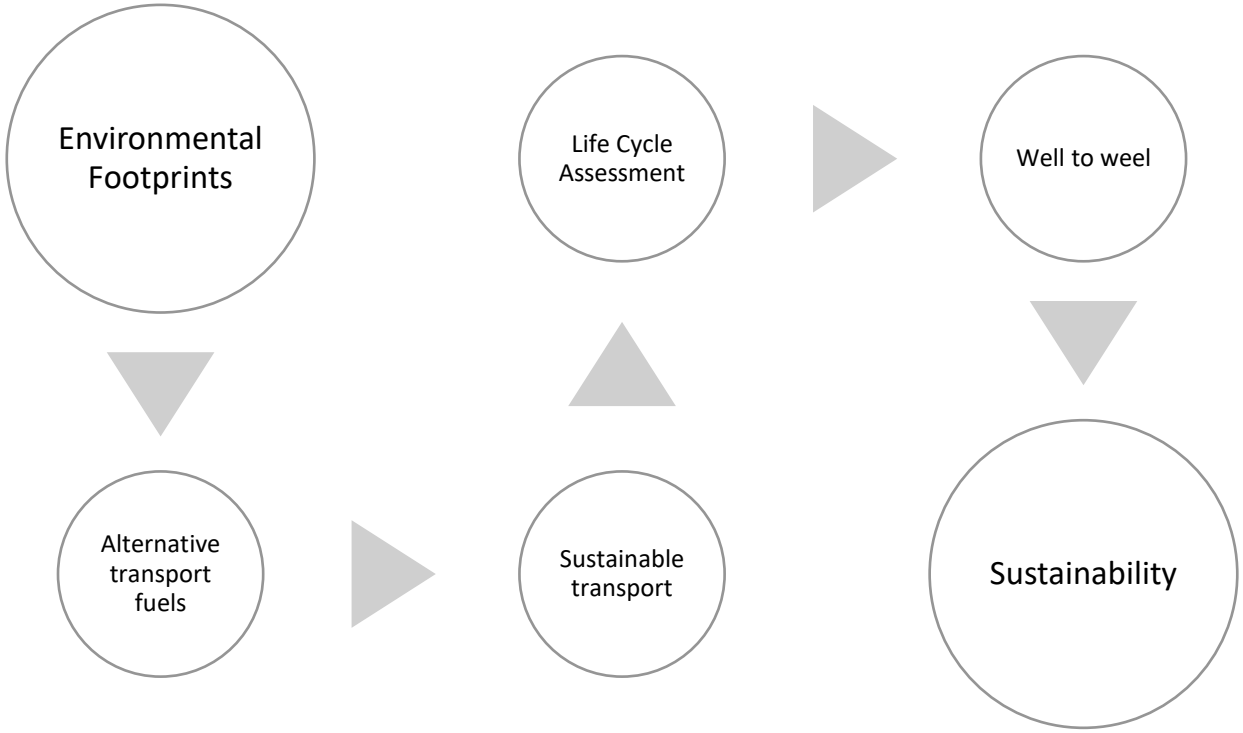

Figure 3 Concepts defined in the aLIFEca MOOC course

The MOOC aLIFEca course presented the results of scientific research regarding the environmental assessment of the life cycle of vehicles (Fig. 4) [7-10]. The main elements of life cycle assessment and methods used to analyze environmental footprints were characterized. Based on the results of the analyses, the determinants of the assessment of the environmental footprint of conventionally powered vehicles and electric vehicles were presented. A comparative analysis of the environmental footprint of BEV and conventionally powered electric vehicles, including the carbon footprint, water footprint and resource consumption footprint, showed that the analysis results depend on both the selected impact category and the sources of electricity used to charge the batteries of electric vehicles. In the case of an environmental analysis of the life cycle of an FCEV electric vehicle, the result of the LCA analysis also depends on the selected damage category and, above all, on the sources of hydrogen production.

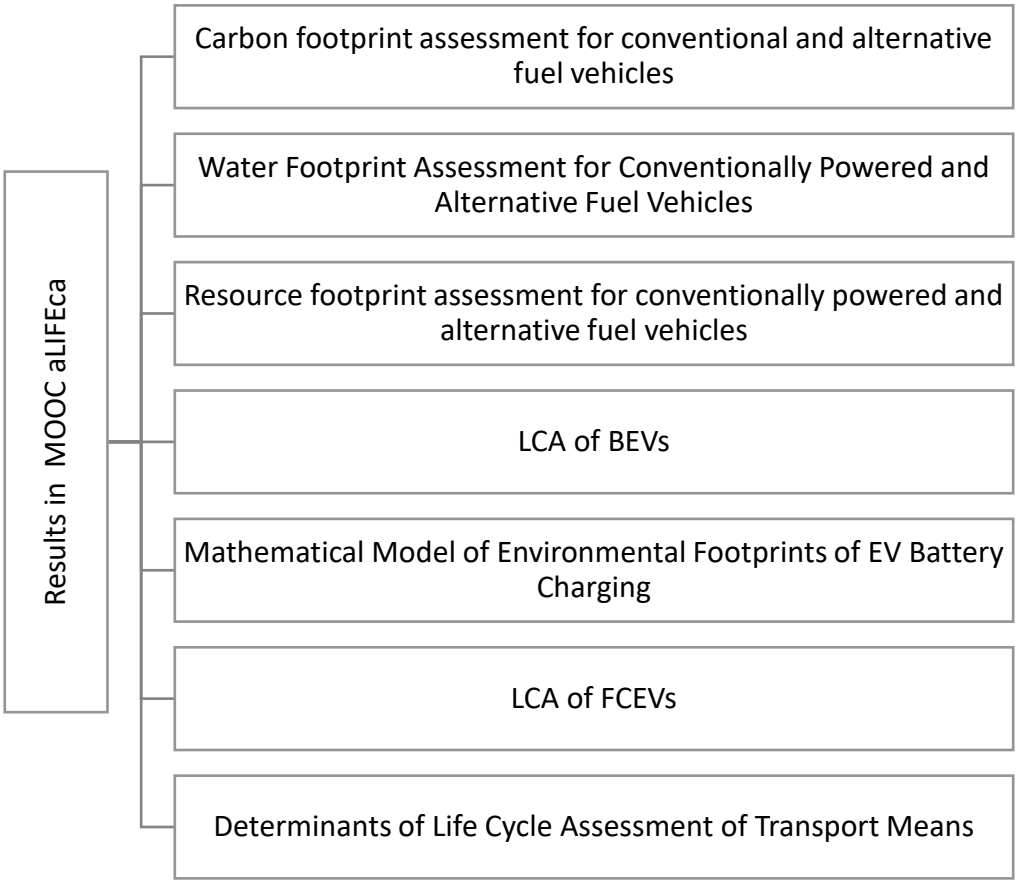

Figure 4 Main research results included in the aLIFEca MOOC

Environmental footprints proposed in massive open online course are adequate and useful tools which can serve the purpose of decision making for the assessment of transport sustainability according to the life cycle approach. However, further research is needed to refine these methods. The environmental footprints indicators thus obtained can be utilised to support decision making in circular economy.

SUMMARY

Understanding the impact of the transport sector on the environment is in the interest of producers, but also of local governments, which decide on the direction of mobility and support for introducing technological innovations. As part of the international project "Virtual Open Course of Automotive Life Cycle Assessment", a specialist course has been developed for the needs of sustainable transport management, taking into account the life cycle approach, in the face of the challenges of green mobility. The MOOC course presents elements of life cycle assessment and methods for the analysis of environmental footprints and the results of scientific research on environmental life cycle assessment of vehicles. Determinants of the assessment of environmental footprints, including carbon footprint, water footprint and resource footprint of conventionally powered vehicles, electric vehicles and hydrogen-powered vehicles are presented. MOOC presents both the current state of knowledge regarding the life cycle assessment of vehicles as well as examples of the use of LCA in the automotive industry. MOOC reflects the specific needs of green mobility requirements in the context of the green economy of the European Union and the European Green Deal plan.

The developed MOOC aLIFEca contains important issues in scientific and research work that should be developed to support decision-making regarding means of transport, taking into account the new guidelines of the circular economy and the requirements of the European Union related to the reduction of greenhouse gas emissions and other categories of environmental impact. The aLIFEca MOOC also includes the results of environmental analyses, including the assessment of the life cycle and environmental footprint of means of transport. This is the first course of its kind in Europe that covers such a wide range of environmental analyzes for both conventional fuel vehicles, BEVs and FCEVs. Additionally, course participants can gain knowledge about life cycle analyses, environmental footprints, and software and tools used for LCA analyses. The developed aLIFEca MOOC supports the expansion of knowledge and skills in the development of various environmental aspects of the transport system, with particular emphasis on alternative fuels.

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