Green Skills along the Value Chain of the Automotive Suppliers Industry

Edited by
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McGraw-Hill Education

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GREEN STAR
GREEN skills for enterprises **S**ustainable
Training for **A**utomotive suppliers cluste**R**

Green Skills along the Value Chain of the Automotive Suppliers Industry

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GREEN STAR: Background, Objectives and Partners Involved

Gabriella Bettiol, Federico Crivelli, Chiara Salatin

Introduction

Today, we stand at the threshold of a great transformation that is taking place in different dimensions at the international, national and local levels. The realisation that traditional growth strategies will only get us so far has inspired new thinking about the way in which modern societies deal with financial, climate and resource scarcity issues. As highlighted during the "Good Jobs, Green Jobs" Conference 2015 in Washington, new energy technologies and financial innovation have opened up new industrial and economic possibilities. Smart sustainable initiatives have led to job creation, innovation and local sustainable entrepreneurship. Highly efficient technologies and an intelligent cycle of materials coupled with workers reskilling and upskilling can stimulate a shift in our energy production, transportation and urban development.

According to the International Labour Office "Skills for new green jobs and adaptation to greener work methods are a concern for many constituents and remain a focus of analysis. […]. A broad range of qualifications is needed for technologically challenging jobs, which are mostly at the intermediate and higher skill levels. Anticipation of future skill needs and forward-looking training policies are a necessity in order to meet the skills demand of the sector. There is a need to update industrial and occupational classifications systems. Education and training policies are important for empowering women and helping them access jobs in renewable energy along the whole value chain, and not just in relatively lower-paid jobs in manufacturing and assembling." (ILO, 2014)

The 12th Report on Continuous Training published by ISFOL in January 2012 gave an overview on the ILO -CEDEFOP report "*For Green Jobs, A Global View*" (Strietska-Illina et al., 2011). This document, as well as the publication "*GreenItaly*" by Symbola and Unioncamere (Symbola/Union camera, 2013) conducted in Italy, pointed out the fact that the green economy can be an important growth factor for the competitiveness of enterprises. Even in the worst

period of the economic crisis (between 2008 and 2012), there was evidence that only those companies that had invested in green technologies and products were creating jobs. Moreover, these companies were also better positioned in the foreign markets, with nearly double percentages of market penetration compared to companies which had not invested in stronger environmental sustainability. As far as staff competencies are concerned, development is associated with the following three main types of change:

1) staff reskilling interventions;
2) the emergence of new, highly qualified jobs;
3) upskilling in already existing jobs.

Moreover, special attention has been drawn to the fact that, on the one hand, the demand for green[1] skills was considerably growing and companies reported difficulties in recruiting suitable professional profiles; on the other hand, demand could actually be mostly related to the need for a mix of traditional competencies and "green shades" to be learnt within vocational education and training programs. This analysis confirmed the general trends identified at the 2010 Ministerial Conference during the EU Belgian presidency, and by the opinion of the European economic and social committee[2]. These both highlighted the improvement and upskilling of existing professional competencies through the introduction of green requirements, to be implemented by means of a lifelong learning approach, i.e. through the implementation of targeted actions for greening jobs, rather than expressly oriented to the creation of brand new green jobs.

A recent recommendation to the French Economic, Social and Environmental Council outlined the challenges and the needs to support the so-called ecological transition, coupled with sustainable development policies (Levaux/Genty, 2015). The recommendation states the essential role of industries and identifies three main dimensions: compliance with stricter regulation frameworks to decrease environmental impacts, products and process eco-innovation, development of integrated services for environmental optimisation by leveraging training and labour markets and by adopting a cross-sector approach.

For companies with transversal green competencies applicable to the ecologically innovative development in terms of new products, markets, energy cost reduction and care for the environmental impact, the growth of demand had been reported by the lead organisation of the Confindustria Veneto SIAV project, both in terms of SME human resources (as already pointed out in a previous research study conducted among 70 enterprises), and concerning VET systems.

[1] "Green" has become a shorthand term to describe the wide range of issues, processes, products and services that relate to sustainability and the environment. (International Labour Office Department of Statistics) and we will use it for the sake of brevity, to represent the most specific terms such as greening economy, low-carbon economy, sustainable development, green growth and so on.

[2] Opinion of the European economic and social committee on the topic "Promoting green and sustainable jobs for the EU energy and climate change package" (initiative opinion), (2011/C 44/18)

To sustain green development also in the field of human resources and of continuous training, the German partners of the Green Star project had started with and supplied systematic solutions since the early years of the 2000 decade, thus taking the lead in their function as innovation leaders. According to the 2012 Eco-Innovation Scoreboard (European Commission, 2012) a few EU countries, among which were Spain and Romania, showed a boosting trend towards eco-innovation not sufficiently supported by transversal training actions for trainees and technicians (European Commission, 2015a). As far as policies are concerned, specific interventions towards this goal were also urged for in the Position Papers of the Commission services for the Planning period 2014-2020, in order to favour access and modernisation of the labour market from a green perspective.

A comparison between the Eco Innovation Scoreboard 2010 and 2013, shows a trend of substantial stability both in the EU28 average level of attention, in investment spending and in the countries involved in the GREEN STAR project: Italy, scoring from 98 in 2010 to 95 in 2013; Germany, from 139 in 2010 to 132 in 2013; Spain, from 101 in 2010 to 110 in 2013 and Romania, from 52 in 2010 to 63 in 2013 (European Commission, 2015a).

A more in-depth analysis shows a series of differences between the four involved countries:

In Italy the National Programme on Environmental and Carbon Footprint, based on a voluntary commitment by companies for the evaluation of their environmental footprint and the reduction of the Greenhouse Gases (GHG), emissions are increasingly becoming a fundamental tool to enhance the objectives envisaged in the legislation and governmental policies of the Kyoto Protocol and especially of the "Climate and Energy package", which was adopted at EU level in 2008. Moreover, the Italian Ministry for the Environment, Land and Sea has financed almost 200 SMEs with 5.6 million Euros for the implementation of sustainable and eco-innovative project in different manufacturing sectors. The eco-innovation processes has become part of the R&D investment spending both at public and private level, with public guarantee funds, Regional Operative Plans and specific venture capital funds (European Commission, 2014).

Germany ranked 3rd in the EU-28 for eco-innovation (and second for socio-economic outputs), being one of Europe's top performers. In regard to resource efficiency outcomes, Germany is close to the EU average for material, water and energy productivity as well as for greenhouse gas emissions intensity. The ISO 14001 standards do not represent a concrete indicator, as a large part of German enterprises prefers the adoption of the EMAS certification (European Commission, 2015b).

In Spain the general R&D and innovation budget slowly decreased from 2010 to 2013, reaching 1.33% of the overall GDP. Data show a strong commitment of Spanish companies on eco-innovation activities. The number of Spanish firms that have implemented the ISO14001 standard is still increasing, reaching 416 per million population in 2013 (361 in 2011), the highest in the EU (with Romania). Furthermore, the number of EMAS-certified organisations remains very high. Spain is the second EU country with the highest number of worksites that have an Environmental Management System (European Commission, 2013a).

Romania ranked 28th in the EU-28 for eco-innovation, due to the "lack of efficient management of the available resources that poses problems to sustainable development in Romania" (European Commission, 2013b). Firms having implemented eco-innovation actions or investments related to the raw material input reduction are only 0.10% of all firms, while investments in reducing the energy input per unit output as a percentage of the total number of firms represented 11% of all firms, i.e. 75% of the EU average. Moreover, the number of enterprises complying with the ISO 14001 standards in their manufacturing processes reached the rate of 413.7 per million inhabitants in 2012, showing a progressively increasing trend.

1.1 The GREEN STAR Project

Goals

The general aim of the GREEN STAR project consisted of the contribution to the improvement of cooperation between Vocational Education and Training (VET) and the labour market through the transfer and use of a training module for the acquisition or the improvement of green competencies targeted towards trainees and workers, and developed within the Leonardo DOI GT VET project for the iron and steel sector, with the significant participation of large enterprises. Since its design, the blueprint of the European module for sustainable training to be transferred through the Green Star project has included the involvement of small and medium-sized enterprises in the definition of contents, training methodologies and the adaptation to the VET systems implemented in the various EU countries.

The involvement of SMEs makes it possible to anticipate the needs for green skills and the strategies to satisfy them. Countries involved in the transfer could therefore take advantage from the analysis already completed on the national VET systems by the GT-VET project. The developed model was implemented in the cluster of automotive suppliers, as it is characterised by the predominance of SMEs. Indeed, according to data presented by the CARS 21 group (European Commission, 2007) coordinated by the DG Enterprise and Industry, in 2011 the automotive industry employed more than 2 million people in the EU countries, and also indirectly provided labour for another 10 million people both in large enterprises and in SMEs, thus covering 4% of the GDP with a trade balance of €90 billion.

The challenges ahead make it necessary to address the emerging issues of eco-sustainability and safety, especially in SMEs. CARS21 has shown the future market changes in its Recommendation to the European Commission, Vision 2020, which can be summarised as follows (European Commission, 2010):

A. A wider use of new advanced technologies (clean, low energy, safe, quiet, easily connected);
B. The further development of a range of propulsion technologies that, although dominated by advanced combustion technologies, are increasingly assisted by electrical devices;

C. A trained and specialised workforce in all sectors making up the manufacturing process (from in-house R&D of large enterprises to the whole supply chain). This workforce will be able to actively contribute to the innovation process by applying new, green technologies and reducing their carbon footprint.

The CO_2 emissions regulation remains a crucial priority without compromising the competitiveness of the EU automotive industry. Reaching the set targets appears possible only by adopting an effectively integrated approach among all the supply chain components. The measures to be taken will be proportionate, efficient in terms of cost/benefits and adjustment control, also the accessibility of new vehicles will be properly taken into account. SMEs and large enterprises will focus their eco-innovation R&D aiming at reducing the fuel consumption, avoiding an excessive cost increase by introducing significant elements of flexibility.

The innovation potential in the automotive sector namely required a skilled labour force with high competencies to implement eco-innovation. This was due to the fact that the automotive sector was faced with difficult challenges, such as globalisation and increasing needs in terms of safety and protection of the environment, especially affecting SMEs. Cooperation with VET systems therefore appeared necessary and urgent, especially concerning the training of apprentices both in the workplace and during classroom training sessions, in order to provide also SMEs' human resources with professional green skills until then developed and used only by large enterprises.

Origin

The original idea of the GREEN STAR project was the transfer of the European training module implementation process developed within the Leonardo project Development of Innovation (DOI) "Greening Technical Vocational Education and Training (GT VET)", for the acquisition and the development of green skills owned by technicians in the fields of industry, mechanics, electronics and electrical systems of the iron and steel sector, to the cluster of automotive suppliers.

The GT VET project had explored short VET schemes which met the skills requirements for sustainability, health and safety of workers in the iron and steel industry. In particular, it had developed an example of a sustainable training module designed according to the ECVET (European Credit system for Vocational Education and Training) standards in order to make it exploitable and transferable to the national /local VET systems across the EU. GT VET had been jointly developed by three large enterprises of the metalworking sector (ThyssenKruppSteel, Tata Steel, ArcelorMittal) in collaboration with the research institutes of four EU countries, with the aim of suggesting actions to identify and anticipate the impact of environmental legislation on daily working activities of electrical and mechanical technicians, by upskilling their competences.

The project was defined as an innovative practice at the 2012 Green Skills Forum organised by the OECD and CEDEFOP, within the framework of initiatives led by and with enterprises. It was implemented and successfully

tested for the acquisition of green skills by electrical and mechanical technicians and apprentices.

Process

Within the GREEN STAR project, the GT VET implementation process was specifically aimed at becoming a reference model, i.e. a blueprint for the acquisition of green skills for sustainable innovation in technical VET programs of other industrial sectors. Success was guaranteed by an industry-driven approach, both in the definition of needs and in the identification of contents and practical methodologies, i.e. an approach based on the interaction of minimum standards required at legislative level, corporate policies and the anticipation of skills requirements. The training sub modules were developed and tested in four EU member countries (Germany, the United Kingdom, Poland and Italy), therefore they can be adapted to different VET systems and contexts. To sum up, GREEN STAR has been aimed at adapting the industry-driven process of the iron and steel sector, mainly consisting of large enterprises, to the SME cluster of automotive suppliers related to several sectors (metal works, microelectronics, plastic materials) through the implementation of a cluster-driven approach. This solution has enabled and will enable the development of suitable competences for sustainable innovation in the training paths addressed to workers ("reskilling") and apprentices ("upskilling"), in order to reduce the environmental impact in production as well as service activities, and to better manage available resources.

From a geographical point of view, results were transferred from the GT VET's German lead partner, the University of Dortmund (TUDO), to Italy, Spain, Romania and disseminated at EU level. The training module was transferred to small and medium enterprises in the three countries involved, through the adaptation of the specific action plans implemented in three SMEs, which took up a lead role in their relevant clusters. Transfer activities were supported by a partnership made up of enterprises and VET representatives associated in a Consortium. Both in its structure and in its working methodology, this association was based on the triple helix model (state - industry – university) aimed at strengthening cooperation for sustainable innovation between public bodies, service organisations and enterprises, universities and VET centres.

This approach aimed at creating favourable conditions for cooperation across the three types of stakeholders, through the interaction of three dimensions, namely knowledge, policies and innovation. Finally, transfer further continued from ecologically compatible, change-oriented reduction contexts to other sectors previously less sensitive towards these issues.

The German core partner TUDO transferred the documentation to the GREEN STAR Consortium, including:

- A report of the industry-driven analysis concerning the necessary professional skills for technical functions and aimed at sustainable innovation according to the EU legislation and the national regulations of four EU countries;
- An analysis report of the VET systems anticipating the skills needs for a smart and sustainable growth in Europe;

- Learning objects related to 4 learning units which make up the module "Sustainable Training for the European Steel Industry", and have been tested in companies and within VET courses for apprentices;
- A summary of contents of the GT-VET training manual presented at the GT-VET final conference on 20th February 2013 and the published final version from March 2013.

The GREEN STAR consortium also used the material and experience learned from the Partner to:

- Transfer knowledge and methodologies developed in large enterprises and concerning contexts particularly sensitive to the issues of smart, sustainable and inclusive growth, to SMEs operating in contexts where these issues are still not perceived as closely related but as opposing needs;
- Transfer the methodology of participation, which favoured the development of training schemes perfectly in line with the technical and regulatory requirements of the industry driven sector, and adapt it to enterprises belonging to other sectors and the cluster of automotive suppliers (cluster-driven approach);
- Implement the methodology to anticipate the green skills needs to be addressed by local VET systems, both for male and female workers in a company ("reskilling"), and for apprentices at the very beginning of their professional career ("upskilling");

Actions undertaken by the GREEN STAR consortium allowed to:

- Identify green skills in the reference cluster in order to proceed with the integration of training schemes for apprentices and technical professional profiles;
- Transfer and adapt the European model for the acquisition of green skills, which was developed for the large enterprises of the iron and steel sector, to the cluster of automotive suppliers (SMEs) in Italy, Spain and Romania;
- Extend the impact of adaptation to other sectors and stakeholders.

Results

The added value of the project lies in strengthening the impact of an excellent model on organisations and final recipients working in different sectors and systems, thus extending the geographical and sectoral scope of the results. The introduction of methodologies and contents developed in a sector with a strict environmental regulatory framework will provide the cluster of automotive suppliers, mainly SMEs, with innovative approaches for on-the-job training, thus contributing to the enhancement of the VET role concurring to a smart, sustainable and inclusive growth.

Current practices and the relevant learning results have been assessed in terms of experience, knowledge and skills for sustainability. Based on this innovative analysis both in terms of methodology and contents, GT VET developed a European training module integrating technical VET programmes with a specific focus on green skills and on sustainable innovation. The contents and structure of the model, subdivided into four key learning units (energy, raw

materials, noise pollution, and waste treatment), have been successfully tested and integrated into continuous training programs implemented by the companies involved in the project. The quantification of learning results into ECVET credit points has laid the necessary foundations for adaptation to the reference VET systems and for the transfer of results to other technical professions and industrial sectors.

Green Star partnership went further by transferring and adapting the modules to small companies in the automotive sector. The participative approach led to the identification of two modules (energy, waste) to be adapted and to the development of a new module (Life Cycle Assessment) according to the GT VET blueprint and the methodology.

The outcomes and results are publicly available through the website: www.greenskills-project.eu.

1.2 The Partnership

The Consortium consists of a group sharing a common interest in providing SMEs and workers/apprentices with knowledge and experiences acquired by a few large enterprises for the upskilling of technical green competencies contributing to sustainable innovation. Sustainable transfer and implementation was taken into account right from the beginning of the project by setting up a kind of eco-system for a social innovation process[3]. This means that in the represented European regions a company, training institution and regional authorities working together since the beginning of the project guaranteeing not only the integration of practical relevance but also the transfer of the results within the regions (within "action plans"). Beside the integration of the know-how of the coordinator of the blueprint GT VET additionally a European institution (EVTA) were integrated to cover the European perspective and transferability.

On this background the consortium has been set up with the participation of the following members:

- **Applicant co-ordinator (CO-APP) - P0:** Confindustria Veneto SIAV S.p.A. - IT - ITALY - Company (services) - (ENTCOMPSer);
- **Core partner (PA-CORE) - P1:** Technische Universitaet Dortmund, Sozialforschungsstelle, DE – GERMANY - University or higher education institution (tertiary level) (EDU-UNIV);
- **Core partner (PA-CORE) - P2:** Federación Vizcaína de Empresas del Metal - ES - SPAIN - Enterprises,

[3] The eco-system approach is becoming more and more relevant in the social innovation debate in general, embedding stakeholders and actors from economy, policy, science and civil society in a region.

social partners and their organisations at all levels, including trade organisations and chambers of commerce and industry (ENT);

- **Core partner (PA-CORE) - P3:** Camera de Comerţ şi Industrie Cluj - RO - ROMANIA - Enterprises, social partners and their organisations at all levels, including trade organisations and chambers of commerce and industry (ENT);
- **Core partner (PA-CORE) - P4:** Regione del Veneto - Sezione Lavoro - IT - ITALY - Public authority (regional) (PUB-REG);
- **Core partner (PA-CORE) - P5:** A.P.I. APPLICAZIONI PLASTICHE INDUSTRIALI S.p.A. - IT - ITALY - SME (ENT-SME);
- **Core partner (PA-CORE) - P6:** BRUSS JUNTAS TECNICAS S.L. SOC. EN COM. - ES - SPAIN - SME (ENT-SME);
- **Core partner (PA-CORE) - P7:** SC SINTEROM SA RO - ROMANIA - SME (ENT-SME);
- **Core partner (PA-CORE) - P8:** European Vocational Training Association - BE - BELGIUM - Adult education providers associations (ASC-ADEdu)
- **Silent partner – P9:** Fòrema Srl – IT – Italy – Adult and Vocational training provider.

Against this background the activities of the consortium are divided as follows:

- The transferring partner P1 -University of Dortmund, in cooperation with the GT-VET partners, provided its scientific expertise to support transfer and adaptation of the GT-VET Blueprint to the partners ' different contexts and VET systems;
- With its consolidated experience in the implementation of national and transnational projects, the lead partner Confindustria Veneto SIAV involved a wide network into the project, including the regional offices of the Italian industrial manufacturers' associations, the relevant services and training agencies, as well as the national level of the Italian industrial manufacturers' associations with Sistemi Formativi Confindustria - SFC, and the some leading European organisations : OECD – Organization for European Cooperation and Development, CEDEFOP - European Centre for Development of Vocational Training and EUROFOUND - European Foundation for the Improvement of Living and Working Conditions. It thus had the opportunity to work on the demand as well as on the supply of technical training on the workplace.

- Similarly, thanks to their constant relations with the SMEs in their respective territories, the partners Federacion Vizcaina de Empresas del Metal and the Chamber of Commerce of Cluj provided their support in facilitating and consolidating the adaptation of the blueprint for the cluster of automotive suppliers, as well as the development of an early detection system of the needs for green skills and the introduction of intergenerational cooperation as an in-company training method.
- The partners API - P5, BRUSS - P6 and Sinterom - P7 are leading SMEs in the cluster of automotive suppliers in their respective countries, and they provided their support in the definition of the needs for green skills among technical professional profiles, in the implementation of action plans to test the adaptation of the module, while also multiplying the successful results to other companies of the same cluster.
- The partners Veneto Region, EVTA and Fòrema (a silent partner) supported the implementation of the project activities, and also ensured the sustainability and enhancement of the project results in the continuous training and apprenticeship systems, and for other national and EU VET sectors through the relevant channels and institutional networks.

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2
Green Skills: Relevance and Policies

Giovanni Bernardi, Giulia Meschino, Antonius Schröder

Green skills are of high relevance, not only for environmental protection but for European economic competitiveness. European policies are underlining this fact. The following chapter will first sum up briefly a background to European VET strategies and green skills policies, secondly refer to the main relevant definitions of green jobs and skills and the reference definition for GREEN STAR, and thirdly thoroughly describe the status and relevance of green skills for the automotive industry.

2.1 EU VET Strategy and Green Skills Policy

Even general EU strategies (e.g. Lisbon Strategy, Europe 2020) and policies are giving the ground for the awareness, recognition and development of green skills. Therefore, in the first part this still relevant background is briefly described, followed by the highlighting of the recent focus on the EU level.

2.1.1 General EU Strategies and Policies

Strategies - Lisbon and Europe 2020

The Lisbon Strategy, formulated by the European Council in 2000, articulated the EU's strategic intent to "become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth." To these ends, a ten-year programme, aimed at revitalising growth and sustainable development across the EU was established and this underpinned EU

policy formulation within the last decade (e.g. Renewed EU Sustainable Development Strategy[4]).
EU education and training policies gained impetus with the adoption of the Strategy (Council of the European Union, 2009). The main objectives were, essentially, to raise the quality and effectiveness of education and training systems in the EU to the highest levels and to ease access to education and training for all. To these ends, the European Commission initiated the Education and Training 2010 work programme (European Commission, 2009), with specific education and training benchmarks set for attainment by 2010.

The Lisbon Strategy was updated through the EU2020 strategy. This update maintains the themes of 'growth and jobs' and places the period 2010-20 in the context of recovery from the economic crisis and the urgent need for sustainable economic development. The EU 2020 strategy articulates three main priorities: smart growth, sustainable growth and inclusive growth (European Commission, 2010). Of course, for the purposes of this project, sustainable growth is of the most interest. It is envisaged that the EU will stimulate sustainable growth through two flagship initiatives: 'Resource-efficient Europe', which aims to decouple economic growth from resource and energy use by reducing carbon emissions, promoting greater energy security and reducing the resource intensity of production and consumption; and 'An industrial policy for the globalisation era', which aims to support businesses as they respond to globalisation, the economic crisis and the shift to a low-carbon economy.

The Copenhagen Process

The Copenhagen Process was launched in 2002, in order to strengthen pan-European co-operation in VET and concomitantly, the alignment of European and national-level practice. Member states have committed themselves to a set of common priorities and several universal European principles and instruments have therefore been developed to support lifelong learning, ensure enhanced quality of VET provision and facilitate educational and job mobility within and between member states. Principally, the instruments focus on three primary goals: Firstly, the improved quality of VET provision at national level through the development of a European quality assurance system (EQAVET). Secondly, the facilitation of comparisons of qualifications across Europe through the creation of the European Qualifications Framework (EQF) with which national qualification frameworks must align; and thirdly the development of a credit system (ECVET), so that work experience and qualifications gained in one member country can be validated and recognised in another.

The Bruges Communique[5]

In December 2010, the European Ministers for Vocational Training, the European Social Partners and the European Commission met in Bruges to set the priorities of the Copenhagen Process, and thus the common objectives for vocational

[4]https://www.etuc.org/sites/www.etuc.org/files/st10117.en06.pdf
[5] http://ec.europa.eu/education/policy/vocational-policy/doc/brugescom_en.pdf

training for 2011-2020. (European Union, 2010). In light of the challenges currently facing the EU, the need for responsive, flexible, high quality education and training systems is emphasised. The Communique states that the capacity of VET to respond to the changing requirements of the labour market must be enhanced, and that the changing labour market needs must be integrated into VET provision (content, infrastructure and methods) in the long-term. The transition to a green economy is also identified as a 'mega trend', which impacts on skill needs across many different jobs and sectors. The Communique establishes that the labour market requires a balance between developing generic green skills (e.g. reducing waste, improving energy efficiency) and more specific skills (e.g. the development and utilisation of green technology).

The EU and 'Green Skills' Policy

The EU's Sustainable Development Strategy (SDS) was launched under the auspices of the Lisbon Treaty in 2000 and this overarching policy goal was renewed in 2006. The 2009 Review of the SDS outlines the progress made, in addition to identifying areas for further action. The Review states that whilst the EU has mainstreamed SD into its policies, the economic crisis of 2008-09 served to highlight that sustainability is a key factor for member states' financial systems and the economy as a whole. It refers to the Recovery Plan for jobs and growth (a fiscal stimulus of EUR 200 billion) launched by the Commission in 2008 (which focused investment on clean technologies and infrastructure) and emphasises how crucial it is that measures to support the economy and reduce the social impact of the financial crisis are compatible with long-term sustainability goals. The Review emphasises that the EU must turn the crisis into an opportunity to address financial and ecological sustainability and develop a dynamic low-carbon and resource-efficient, knowledge-based, socially inclusive society. This building of a green economy is increasingly touted as a vehicle for job creation at European and national levels. The EU has also explicitly recognised that green jobs require green skills, and that these play a critical role in supporting a low-carbon economy (e.g. CEDEFOP 2010). EU policy documents in this area clearly advocate government intervention at national level through, for example, subsidising research and early stage deployment into new green technologies. This is seen as being crucial in supporting such job creation.

However, despite the fact that education and training have been identified as the critical foundation in attaining sustainable development and the creation of a green economy, research by ECORYS (2010) for the European Commission highlights the existence of a 'green skills gap'.

2.1.2 Recent EU Focus on Green Skills

"Valuable materials are leaking from our economies. In a world where demand and competition for finite and sometimes scarce resources will continue to increase, and pressure on resources is causing greater environmental degradation and fragility, Europe can benefit economically and environmentally from making better use of those resources. Since the industrial revolution, our

economies have developed a 'take-make-consume and dispose' pattern of growth — a linear model based on the assumption that resources are abundant, available, easy to source and cheap to dispose of. It is increasingly being understood that this threatens the competitiveness of Europe (European Commission 2014a)."

The above paragraph was used by the European Commission in July 2014 to describe the situation which awaits us if we keep on relying on a linear model-based economy. The European Union's aim is to adopt a circular-based economy in order to reach natural resources sustainability and at the same time to create a competitive economy in which green jobs and skills will play a key role. The target that the EU wants to achieve in the relative future is a **Resource Efficient Europe**, also underlined by the **Europe 2020 strategy for smart, sustainable, inclusive growth**.

Circular Economy means to become familiar with terms like *reusing, repairing and recycling*. Nowadays existing products and materials are seen as mere waste, but we should start to look afresh at the goods we buy. In a hypothetical circular economy, all products must be intentionally designed to fit into material cycles in a way that keeps the value added for as long as possible and residual waste is close to zero. As Ellen Macarthur explains[6], we cannot afford to buy and dispose goods in the long-term; we should better focus on the service we buy not on the product itself. She intervened and presented the results of a major new study at the European Commission's stakeholder conference on the circular economy[7] in Brussels on the 25th of June 2015. The report's findings are well timed as the European Commission considers its circular economy strategy and consults with stakeholders in order to develop a circular economy package by the end of the year.

[6] The circular economy: from consumer to user, from (http://www.ellenmacarthurfoundation.org/)

[7] Closing the Loop – Circular Economy: Boosting business, reducing waste, see http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=8260

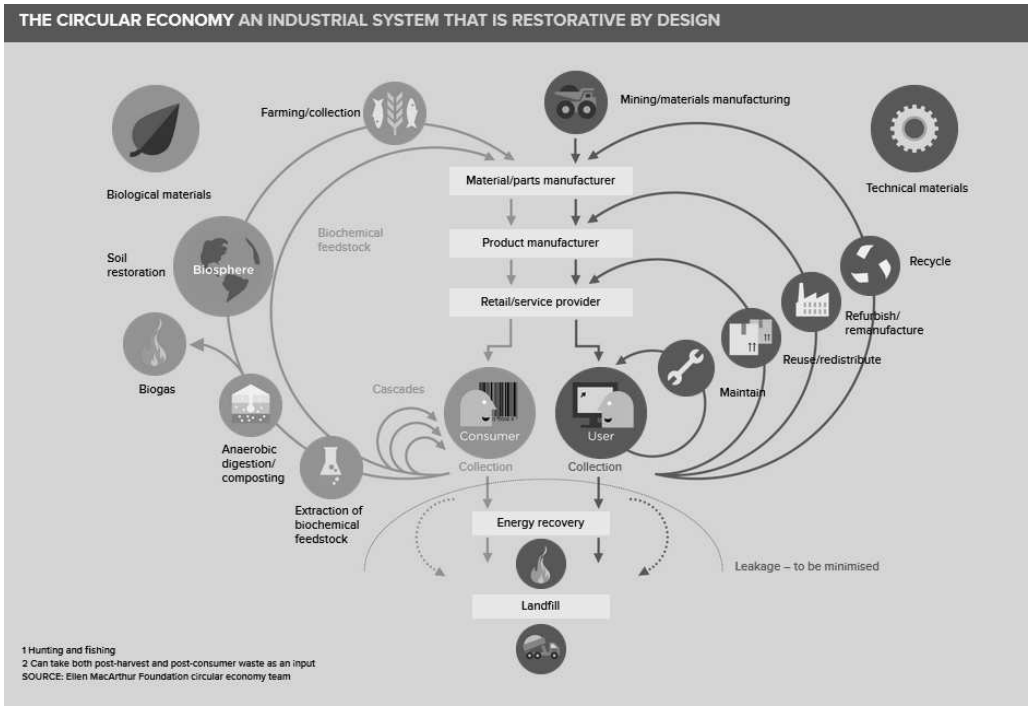

Figure 1 Circular Economy: An interactive diagram Ellen Mac Arthur Foundation[8]

Furthermore, the fact that today's customers buy greener products, services or technologies because they work better, save money or enhance health doesn't have to be underestimated. Many multinationals, like Cisco, Renault and Philips, already have a circular economy team. Eco-brands integrate relevant environmental benefits into products alongside cost and quality and communicate evidence-based messages avoiding "greenwashing".

It is important to step up the ambition by looking more concretely at waste management, and the related key aspects of the value chain, which are essential in order to "*close the loop*" of the circular economy. The circular economy requires action at all stages of the products life cycle: from the extraction of raw materials, through material and product design, production, distribution and consumption of goods, repair, remanufacturing and re-use schemes, to waste management and recycling. It needs the involvement and commitment of many different groups of people.

When talking about green jobs and growth, there is a wide range of divergent interpretations that are used in the EU. Green jobs were previously considered as those involved with protecting biodiversity and the natural environment;

[8] This is just a screen shot and not everything is readable, more information is provided by clicking on the topics in the original on given URL: Source: http://www.ellenmacarthurfoundation.org/circular-economy/circular-economy, see interactive-system-diagram.

nowadays they include other areas such as low-carbon technologies, energy efficiency and carbon finance. The terms "green jobs" and "green skills" are used in different contexts to serve different purposes.[9] This can lead to distortions of statistics on green growth. The European Commission uses a broader definition than EUROSTAT, which stipulates that 'green' technologies and products must have an environmental protection or resource management purpose as their prime objective. Therefore, in order to avoid misleading statistics about green jobs and growth development, a clearly formulated and more limited EU wide definition of green jobs and green growth should be elaborated.

The European Commission, through its roadmap and policies, set out the ways for these new challenges and opportunities. The policies will affect EU citizens and consumers as users of products and services, all economic actors across the product value chains (i.e. manufacturers, distributors and retailers and public administrations); but what are the main advantages and objectives of the policies? The policies' aim is to create conditions for the development of a circular economy by addressing barriers and enabling the development of new markets and business models, in particular:

- Net savings for EU businesses of up to EUR 600 billion
- The creation of new green jobs through re-skilling and up-skilling;
- Improved situation for consumers
- avoided pollution and greenhouse gas emissions, and slower resource depletion
- Increase resource productivity by 30% by 2030, boosting GDP by nearly 1%.

All the objectives were also underlined in the "Closing the Loop" conference organised by the European Commission the 25th of June 2015 in Brussels.

The 'greening' of the European economy, as outlined in the EU 2020 strategy, will have profound effects on the labour market and the development of the skills of Europeans. Re-skilling means improving the collective skill set of staff, while up-skilling aims to enhance already existing skills. These new challenges on green skills and raised environmental awareness implies new VET strategies, priorities and policy recommendations for taking advantage of the transition towards a green economy by facilitating labour-market responses to emerging skill needs. These changes may also lead to a wholesale culture shift, with a strong boost for innovation and research and a significant investment in technology, education, and organisation training for new occupational profiles, new funding methods and appropriate policies.

The **Green Employment Initiatives** by the European Commission aim to support a structural shift to green growth by maximising job opportunities through setting out policy actions to be taken at European and national levels, including:

- Bridging existing skills gaps
- Anticipating change and securing transitions
- Boosting job creation

[9] This is further elaborated in chapter 2.2.

- Increasing data quality and monitoring of labour market developments
- Promoting social dialogue
- Strengthening international cooperation by engaging in the Green Growth Knowledge Platform launched in 2012 by the Global Green Growth Institute, OECD, UNEP and World Bank.

Employment and labour market policies are at the core of the European Semester for coordination of economic policy. European employment policy needs to play a more active role in supporting job creation and in matching labour and skills demands related to the transition to the green and resource-efficient economy. There is significant potential for creating new jobs in the production of energy from renewable sources, energy efficiency, waste and water management, air quality, restoring and preserving biodiversity, climate change adaptation and the development of green infrastructure.

As stated in the EU's Agenda for New Skills and Jobs (European Commission 2015a), the Commission has supported the setting up of **European Sector Skills Councils**; its task is to anticipate the need for skills in specific sectors effectively and achieve a better match between skills and labour market needs. They aim to:

- Provide more and better information about the skills situation in different sectors
- Help to develop skills governance in each sector and national skills policies.

So far, 14 sectors have been recognised and have benefited from Commission funding. They are: Nursing, Construction, Steel, Gas, **Automotive**, Chemicals, Fishery, Furniture, Shipbuilding, Audio-visual and Live Performance, Agriculture, Electricity, Sports and Leisure , and Dairy. The Skills Council in the Automotive sector is going to be built up thanks to CLEPA (European Association of Automotive Suppliers). CLEPA with other partners of the metal, engineering and technology sectors launched a project in December 2010, co-funded by the European Commission, to investigate the potential for the establishment of a European skills and employment council for the automotive sector. This aims for the identification and examination of the labour market, human resources and skills development in the automotive sector at both regional and national level. The project also strives to establish a European network in the automotive sector for exchanging information and good practices at the European level.

In addition, the European Parliament on the 12th December 2013 approved a resolution on "Eco-innovation – jobs and growth through environmental policy":

- highlighting the dual environmental and economic benefits of transition to a green sustainable economy, in terms of creating sustainable jobs
- stressing that these opportunities should generate high-quality, sustainable jobs both for skilled and unskilled workers and
- encouraging the Member States to provide incentives for businesses, in particular SMEs.

The European Economic and Social Committee (EESC) expressed its opinion: "The EESC is convinced that the transition to a circular economy could improve the outlook for achieving the Europe 2020 strategy objectives" (European Economic and Social Committee, 2014c). *"We need tangible measures and*

practical support for SMEs to become more sustainable and ecological. There is a huge potential for the creation of new jobs, provided we can train people accordingly"(European Economic and Social Committee, 2014b)

The growth of Green Technologies and good practices in the past years has shown that investing in green and smart growth is a huge economic opportunity, too good for Europe to miss out on.

2.2 Green Skills for SME Automotive Suppliers: The Neglected and Emerging Relevance

Definition of Green Skills

European and United Nation strategies and objectives (such as Europe 2020 Strategy, Kyoto Protocol and Rio 2012, UN Commission for Sustainable Development (CSD), UN Green Economy Roadmap, and Millennium Development Goals MDG) show the general global and European importance of climate change and the relevance of adjustment and mitigation strategies to climate change, consumption of resources, raw materials and recycling, sustainable management of natural resources, biodiversity and eco-systems, environmental monitoring, environmental friendly economy, green economy and technology.

Against this background, changes within production technologies and greening of production are a continuous challenge and are remaining a mega-trend demanding related "green skills" of the workforce in everyday work. The GREEN STAR project (based on the findings of GT VET) is referring to the increasing relevance of environmental issues in production and the requirement of appropriate skills and competencies from workforce members - particularly from skilled technical workers.

Green jobs and green skills may be defined in different ways. Green jobs are defined by the ILO (2011) as all jobs that are maintained or created in the transition process towards a green economy, that are either provided by low-carbon-intensive industries (enterprises) or by industries (enterprises) whose primary output function is for a greening economy (ILO, 2011). This is such as those generated and maintained in the environmental goods and services sector. The ILO has come up with 4 categories of green jobs: jobs in clean tech companies (category 1), jobs in organisations whose activities are by their very nature not environmentally sensitive (category 2), workers who are doing something of environmental benefit in environmentally sensitive sectors (category 3) and the production of inputs for environmental business activities in sectors whose own environmental behaviour is negative (category 4). Examples that could be highlighted are: workers in a solar plant, a teacher, a chemist developing an alternative fertilizer and a steel worker producing steel for wind turbines.

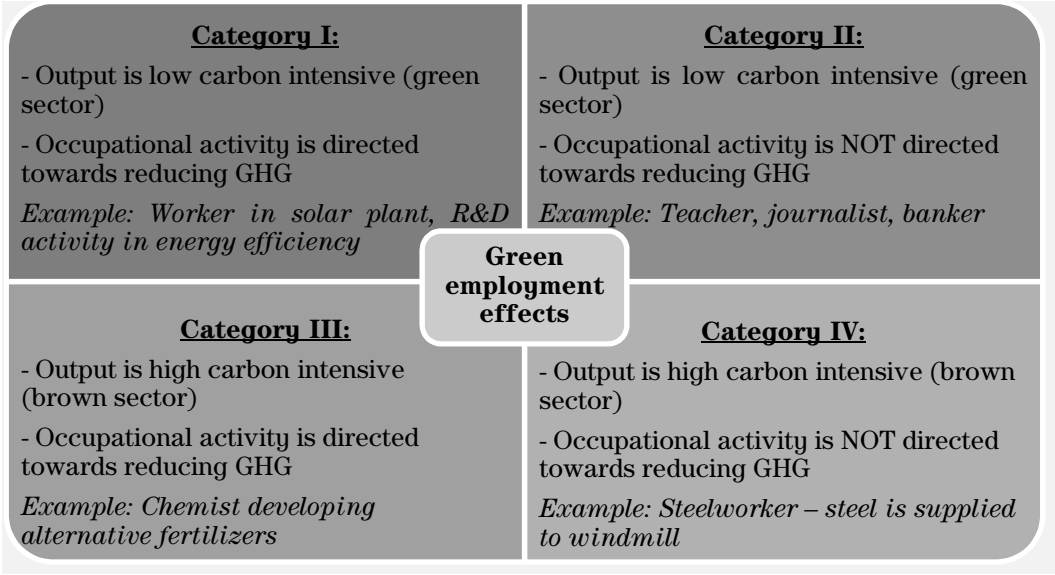

Figure 2 Green job categories – ILO definition (ILO, 2011)

As the related ILO project stated new green jobs are not necessarily high-quality jobs, nonetheless they concur to ensure a safe and healthy working environment, together with a modern work organisation, non-discrimination and gender equality, among others.

Further the ILO defines green skills "…as specific skills required to adapt products, services or operations to meet adjustments, requirements or regulations designed to stem further climate change or adapt to the impact it is already having" (ILO, 2011). This general definition as part of the OECD's broader skills classification is completed with a more vocational education and training (VET) oriented definition given by the Australian Ministerial Council for Tertiary Education and Employment. Green skills are defined as "… the technical skills, knowledge, values and attitudes needed in the workforce to develop and support sustainable social, economic, environmental outcomes in business, industry and the community". [10]

The O*NET classification systematically classifies green occupations and green occupational profiles and provides a possibility to estimate the impact of green skills in relation to skills changes and the numbers of jobs that are included.

Referring to the O*NET Classification[11] three types of green skills are affected:

- **Green increased demand for occupations**: increase of green skills for existing occupations

[10] http://www.ivet.com.au/a/71.html, see also: Dierdorff et al., 2009

[11] Dierdorff et al. (2009) p. 11/12

- Green enhanced skills occupations: green skills that significantly change the work and worker requirements
- New and emerging green occupations: unique work and worker requirements, resulting in the generation of new occupations, entirely novel or 'born' from an existing occupation.

GREEN STAR is referring to the first type of green skills, focusing on new green skills within existing occupations and working activities. This is in line with the statement, that "many existing occupations and industries will experience greening changes to tasks within their jobs, and this will require adjustments to the current training and qualification frameworks for these occupations" (*GREENER SKILLS AND JOBS © OECD, CEDEFOP 2014* – Highlights).[12]

The impact of these three types on the degree of skills changes and the number of affected jobs are different (see the following figure). While new green jobs are requiring high changes in skills and tend to emerge in new occupations but are still related to a low number of jobs, the greening of existing occupations are characterised by only limited (upgrading of skills, new skills) changes affecting a high number of jobs. The greening of existing jobs leads to a middle range of changes in skills but has an impact on a high number of jobs. Increased demand of green skills which do not change the occupations (but only the context of the work) is of low relevance for jobs and skills changes.

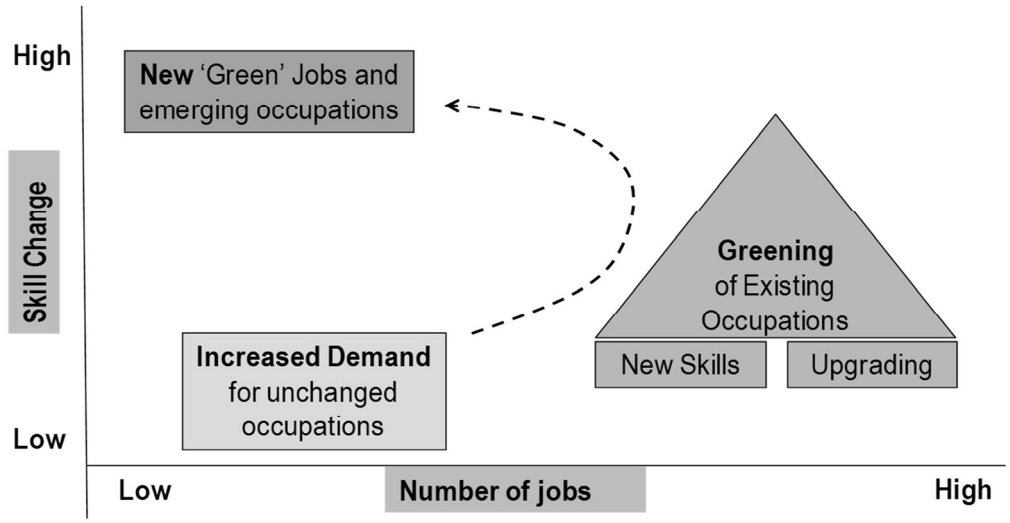

Figure 3 Green Skills and Number of Affected Jobs[13]

GREEN STAR is dealing almost with green enhanced occupations but to a different intensity of new green skills. Most of the relevant occupations of the automotive suppliers are affected by new green skills, other skills are upgraded.

[12] http://www.oecd.org/cfe/leed/Greener%20skills_Highlights%20WEB.pdf, 15.05.2015

[13] Taken from *Schmid, CEDEFOP World Congress on TVET, 13-16 May 2012*

It is also relevant to refer and differentiate between generic and technical green skills:

- Generic skills - the possession by an individual of the qualities and competencies required to meet the changing needs of employers and customers and thereby help to realise his or her aspirations and potential at work (CBI, 1998). Under this broad heading, O*Net includes basic skills, problem solving, resource management and social skills.
- Technical skills - the skills needed to perform the tasks required to produce a good or service, often involving analysis, evaluation or the application of machines or technological systems. Examples of technical/ specific green skills include knowledge of sustainable materials, carbon 'foot printing' and environmental impact assessment skills (Cedefop, 2010).

Examples of technical, specific green skills include knowledge of sustainable materials, carbon 'foot printing' and environmental impact assessment skills (Cedefop, 2010). The objective of GREEN STAR (based on GT VET) is to ensure a c*ontinuous upgrade of green knowledge, skills and competences of the existing workforce within the automotive supplier industry.* This is without forgetting that a short-termed and responsive implementation of industry, company skill requirements into formal education and training and the regional or national VET systems is needed to ensure the sustainability of the green skills development.

Green Skills for the Automotive Supplier Industry

Related to the three differentiations for green skills (O*NET Classification) GREEN STAR is dealing with the increase of green skills for existing occupations (embedding both generic and technical skills). When using the term green skills GREEN STAR focuses on environmental sustainability. But there are clear benefits in terms of social and economic sustainability, too. As skills are acquired and then applied by individuals in different contexts, skills become green when they are applied in green contexts.

Green skills for technical VET in the automotive supplier industry are technical skills and appropriate awareness which prevent and reduce negative impacts on the individual and environment (neighborhood, employees, air, water and ground) caused or initiated by operations and work in and/or around production. Green skills aim to equip skilled workers with competencies for ecologically and environmentally sustainable behaviour whilst maintaining high health and safety standards.

This comprises knowledge, abilities and attitudes

- To save and reduce input of resources, particularly energy
- To prevent and reduce emissions, pollution and noise
- To utilize, store and dispose waste materials in a manner that conforms with best practice environmental procedures and understands the consequences of nonconformity
- To understand the value, impact and lifecycle of resources and materials
- To keep track of current standards and best available techniques.

The Neglected and Emerging Relevance

The automotive sector meets the environmental issues to a considerable extent, both in terms of environmental pollution and in the consumption of energy and resources.[14] In 2007, road transport accounted for 23% of total CO_2 emissions in the EU15 area (EEA, 2009). According to an EIPRO study (European Commission, 2006) conducted by the JRC, the transport sector accounts for about 15% of total pollution.

We are interested in drawing attention to two dimensions of the green issue which are specific of the automotive sector, i.e. on the one hand the importance and influence of the time trajectory of the product life-cycle (Life Cycle Assessment – LCA), as will be further analysed more in detail subsequently; on the other hand, its relationship with a logistic structure organised according to long sub-supply networks. This focus of attention has its importance both for the product complexity and for the number of its components, as well as for the wide range of technologies concurring to it and, finally for the necessary outsourcing strategies. The various materials, components and other purchased external inputs account for between 60% and 80% of the production costs, thus making the automotive sector one of the sectors most dependent on the production chain (Van Weele, 2010).

This trend is still growing, despite the overcapacity attributed to the final assemblers/Original Equipment Manufacturer (OEMs).

By linking together the LCA and the production chain, a distinction is necessary between possible interventions and effects concerning the issue related to the skills of different professional profiles, the two macro phases of production and product in use or, in other words, sustainable production and sustainable consumption (Lee 2011). It is clear that the second aspect, while being relevant for the environment, is much less so for the working activities of our interest.

Direct effects related to production, and indirect ones related to use, are obviously related from a functional point of view, however they can be separated in terms of goals, areas of intervention and generation of the necessary competences.

Before the relevance of green skills for SME in general and automotive suppliers in particular, the relevance of the afore mentioned Life-Cycle-Assessment will be shown.

Relevance of the Life Cycle Assessment (LCA)

The interpretation, analysis and intervention model of LCA is widely used and known; therefore any introduction to this topic is not necessary. However, mention must still be made of its great significance, to the extent that this model has been implemented as one of the three relevant areas of the GREEN STAR

[14] Nowadays, 96% of the world's transportation systems depend on petroleum-based fuels and products, with the global transportation systems accounting for about 40% of the world's oil consumption. Mayyas, A., Qattawi, A., Omar, M. Shan, D., 2012.

training module and is added as a new component not part of the GT VET blueprint. Therefore, here the focus of attention will lie on its relevance.

"An environmental pressure as to be considered on different phases of LCA imposed on the automotive industry cannot be denied" (Martinuzzi et al, 2011)).

Firstly, the following areas of intervention can be identified: sustainability and production, sustainability and product use, sustainability and end of life-cycle. According to Whitelegg (1993), about 10% of the environmental impact concerning the entire life-cycle of a motor vehicle can be attributed to its production process. About 80% of the impact is associated with the use phase, and the remaining 10% concerns the post-use phase. The following figure shows a simplified model of the life-cycle of a motor vehicle, which also highlights the main green issues associated with each phase ((Martinuzzi et al, 2011, p. 11):

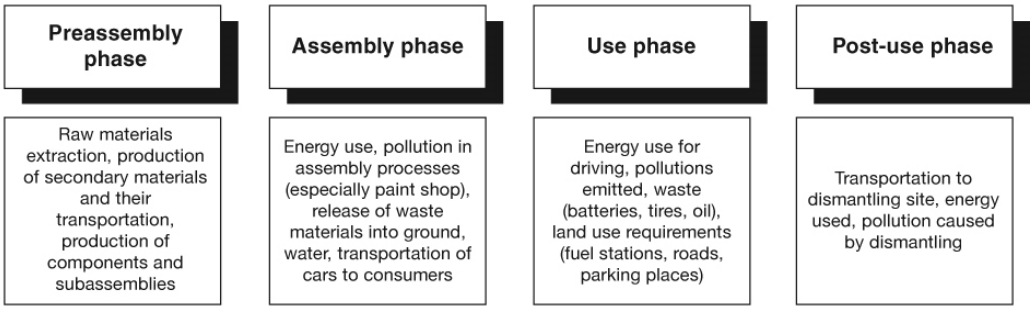

Figure 4 Simplified model of the life-cycle of a motor vehicle

In consideration of these factors, the need to introduce aspects of eco-innovation pervades throughout the whole value production chain. The intermediate and final phases are probably the most interesting ones in terms of relevance for the specific sector policies as well as economic ones (Nemry, 2008). This assumption is made not only from our perspective, but also in the identification phase of the necessary competencies.

Another important reason which led to taking into consideration the whole production life-cycle (Montalvo et al., 2011) is related to the potential trade-offs with the different phases: improvements resulting from impact reduction in a production phase can lead to an increase in other process steps. By way of example, the replacement of a few metal parts with plastic ones on motor vehicles provides an advantage in terms of the total weight of the product and, consequently, of fuel consumption rates. However, this change can lead to an increase of criticalities in the component recycling phase.

Suppliers' relevance on green results

As already stated, the automotive sector is one of the most supplier-demand based production sectors, and this characteristic also has repercussions in terms of eco-sustainability of the final product. Owing to the high level of outsourcing through the production chain, car manufacturers became aware of the need to deal with the environmental problem long before products and materials entered

the company's direct control structure (Brent, 2005). From an economic point of view, and as already highlighted, materials and different components delivered by sub suppliers can make up to 80% of the total value of the vehicle, thus their environmental relevance must be taken into consideration (Orsato and Wells, 2007).

A few studies (Montalvo et al., 2011)) attempted to define the potential for green improvements in the automotive sector, which mainly goes through the involvement of sub suppliers. It is stated again that in this sector, either directly or indirectly, the relevance rate of these actors is among the highest (according to the author's score table, it ranges from 4.5 to 9.5). The introduction of new ecologically innovative materials shows an impact of 36% (Kemp et al., 2013).

Other authors also point out that the introduction of specific environmental regulations generates new stimuli that can affect different sectors and types of innovation (Montalvo et al., 2011). For each type of environmental and energy regulations, these studies show several effects generated in the relevant industrial sectors of interest. The fact is also highlighted that, in all examples quoted, the automotive sector emerges as the leading sector that draws the maximum potential advantage from green investments, starting of course from the high incidence on the total environmental impact.

The potential is there, what about benefits?

In discussions about environmental strategies, entrepreneurs often raise doubts about this question: Is there economic benefit in being green, or is it just a investment gift for the enterprise business, which is probably worth doing only for large multinational companies, or with the availability of incentive public funds?

Difficulties in quantifying costs and benefits deriving from the implementation of environmental sustainability practices produce a very subjective answer to this question. For this reason, the green choice must also prove its economic sustainability in order to be feasible for a SME.

The situation seems to be progressing, at least in the medium term, not only because of the implemented policies, but also as a consequence of greater external attention being spread on this issue, and making it among the top priorities for enterprises, both for the products and for the company in terms of image.

Several research studies and opinions reach the same conclusion that companies can derive important benefits from implementing sustainable strategies in their corporate activities, on the condition that a global strategic vision is implemented, rather than as mere individual actions (Bonn and Fisher, 2011). Green actions can produce advantages for industrial purposes and for the global company image every time they translate into long-lasting competitive advantages. Moreover, they need to become a key element of the corporate mission and of the global strategic plan.

The growth in the world production of motor vehicles has caused an important environmental problem, both at local and at international level (Gerrard and Kandlikar, 2007). Car manufacturers, vehicle producers and suppliers are introducing green strategies as standard practices in their

production routine for several reasons (legal and economic reasons, increase of competitiveness, improvement of the company image). Regarding this issue, a few studies show that the implementation of management practices to deal with environmental issues produces benefits and advantages for the companies (e.g. Zhu and Geng, 2001, Zhu et al., 2005), among which possible improvements of productivity, competitiveness, profitability and, once again, image.

These advantages can be obtained through the definition of two basic objectives: (1) the reduction of waste produced and (2) the maximisation of effectiveness in the use of resources (by means of recycling and reuse).

The relevance of SMEs as suppliers in the Green Supply Chain (GSC)

Competitiveness has obviously increased already extreme tensions on costs. Even a traditional car, with carbon-based fuel, but greener in the more modern traditional technologies already available, can cost about 3,000 to 5,000 Euros more. These additional, green related costs are largely offloaded on suppliers and reabsorbed in costs for design, for the learning of cost saving strategies and by traditionally resorting to outsourcing.

The extensive network of suppliers and sub-suppliers along its value chain is pressurised by cost reduction. In this tier-structured system, lower level organisations provide an input to the higher level supplier until the final car assembly.

This lengthening and scattering of the supplier network or chain increases the number and also the central role of SME suppliers, which are generally small and now also fragmented. It is difficult for these companies to find the resources to innovate versus green issues and they lack the suitable size to address the high volume requirements of standardisation. On the first tier, instead, suppliers have implemented globalisation and aggregation strategies and their size has become important (e.g. Bosch, Valeo etc.)

As far as the average size of the supply base companies is concerned, enterprises tend to be small with the exception of Germany (MacNeill et al., 2005). The average number of workers is: 375 in Germany, 110 in Sweden, 120 in France, 70 in Italy, 75 in Spain. The small and medium sector chooses:

- To innovate and add value to the product
- To consolidate, or cooperate, in order to reduce fixed costs and achieve a larger scale
- To diversify with the same technologies in other industrial sectors, to avoid being exclusively dependent on the motor vehicle industry.

These choices mainly depend on specific positioning in the value chain with a shift from a product-based downstream logic to a technology-based upstream one.

As far as the development of green skills is concerned, as the supply chain gradually becomes more integrated, the opinion inevitably arises that the result depends not so much on the single enterprise, but rather on the whole chain: This leads to the green supply chain (Seuring et al., 2008) (GSC) logic. When the focal company is under pressure, it usually passes this pressure on to its suppliers. Here, one distinctive feature of the sustainable supply chain management emerges.

OEM companies (Original Equipment Manufacturer) need to develop strategies and approaches that foster the willingness among suppliers to take part in green supply chain initiatives.

Green Supply Chain Management (GSCM) is "an organizational philosophy which helps organizations and their partners to achieve corporate profit and market-share objectives by reducing environmental risk and impacts while improving ecological efficiency" (Rao and Holt, 2005).

Three aspects have often been mentioned as barriers towards implementing sustainable supply chains: (1) higher transaction costs, (2) coordination effort and complexity, and (3) insufficient or missing communication in the supply chain, mostly on medium-term technologies and product trends that OEMs are reluctant to release to suppliers.

These barriers are mainly based on the relationship between OEMs and suppliers, which can be different in several industrial contexts and among companies which are more or less delocalised from their territory of origin, but most of all on the sourcing policies implemented by OEMs which involve suppliers to a wider or lesser extent into their strategic choices. In any case, the final green results largely depend on sub-suppliers.

External pressure and regulations have been driving focal firms to turn towards including small and medium-sized enterprises (SMEs) in the environmental improvement process of entire supply chains, mainly for two reasons.

Firstly, disruption risks engendered by environmental issues can pass on through suppliers. The problematic wires with high levels of cadmium supplied and assembled in the Sony Playstation is a classic example. If there is an inconvenience for the final product which is negative for the brand image, the blame is on the supplier, beneath affecting negatively the brand image.

Secondly, the supply chain base primarily consists of SMEs. For example, 93.5 percent of the suppliers in the Korean automobile industry are SMEs (Choi, 2003). Therefore, the involvement of SME suppliers is vitally important in achieving corporate environmental targets (Holt et al., 2001).

The Green Supply Chain (GSC) encompasses a broad range of practices, from green purchasing to integrated supply chains flowing from suppliers to manufacturers, to customers, and to the reverse supply chain, which is "closing the loop" (Rao and Holt, 2005). From a life-cycle perspective, initiatives striving to achieve the goal of the GSC, a notable environmental and economic gain for the entire supply, are hard to implement successfully without the deep involvement of the supply chain partners. In other words, it is crucial to include SME suppliers in the supply chain-wide environmental improvement process.

As a result, SME suppliers can be considered as the missing links (Lee, 2011) between SME environmental management and green issues in the supply chain management. Small and medium-sized supplier firms have limited available resources to implement effective environmental capabilities and usually lack the information, resources, or expertise to deal with environmental issues. They have little knowledge in bringing into effect the technical and managerial changes that would enable them to meet emerging environmental and social standards (Luken and Stares, 2005).

Therefore competition is moving from less "firm vs. firm" to become more "supply chain vs. supply chain" oriented (Hult et al., 2007).

There is also a neglected aspect in the relevance topic: Most studies have focused on producer and/or manufacturer-related aspects, while supplier aspects are rarely explored (Caniels et al., 2013).

Companies that adopt a clear approach to green practices in combination with appropriate internal supplier management strategies, run a reduced or minimal risk of losing their reputation, which in turn leads to a competitive advantage (Leppelt et al., 2011).

Difficulties in characterising green strategies in SMEs

As already stated, aspects like image and public perception of an automotive OEM (Original Equipment Manufacturer) with respect to green issues is not only dependent on its own green performance, but also on the performance of its supply chain members, since the OEM is held responsible for the sustainability of the entire chain.

This involvement of suppliers in the OEM's product development has led to (Volpato et al., 2004):

- The relocation of knowledge and tasks within the supply chain
- A major organisational change within the OEM and in the buyer-supplier relationship (information flows, team staffing and building, etc.)
- The redefinition of the tools (managing the relation of the involved companies and based on engineering practices).

Despite the apparent pressure in major brands, the overall size and frequency of environmental regulations significantly associated with innovations is relatively low compared to other sectors (Bianchi et al., 1998).

The introduction of a pro-active green strategy within SMEs is really problematic for two major reasons. Firstly, it requires resources and skills that, in many cases, are not available in SMEs. Secondly, at present it can hardly be justified from an economic and competitive point of view, since management has to invest significant financial resources (new equipment, training, creation of new skills, etc.) without any certain returns in the short/medium term. It must be remembered that most customers do not yet wish to pay an additional price for environmentally friendly products/processes. It is thus very difficult for SMEs to publicise their efforts in the environmental field to external stakeholders, thus often creating problems in terms of "green" image.

Nevertheless, for decades, car manufacturers have realised the importance and the competitive advantage of environmental protection, especially in the German automotive industry which has always been long-term-oriented.

Attention to environmental aspects begins by introducing new technologies in the manufacturing process, also in close cooperation with suppliers. OEMs develop their own standards that usually go beyond the ISO requirements, particularly when it comes to environmental issues. These green standards are defined by the car manufacturer, but sometimes they are also developed together with key suppliers.

Typically, large buyers pass on ecological pressure along the supply chain to their suppliers, thus increasing the exposure of upstream supply chain members

to environmental regulations (Noci and Verganti, 1999). One approach to accomplish better environmental supplier performance is via the diffusion of standardised environmental management systems such as ISO14001. Focal companies might establish this as an "order qualifier", which has to be met before a supplier is considered for an order at all (Zhu and Geng, 2001).

Obviously those who are interested in the development and enforcement of ISO 14000 have already implemented it: there is a difference in the implementation of environmental practices between companies that possess some form of certified environmental management system (ISO 14001 or EMS) and those that do not have any system of this kind. Companies with a certified EMS are also making additional environmental demands on their suppliers.

This positive relationship was found to exist between the possession of certified EMS, specifically ISO 14001 and an eco-management and audit scheme, and the environmental demands that these organisations impose on their suppliers (Gonzales et al. 2008). There is resistance in the implementation of ISO 14000 standards, which is justified by the often ungrounded fear of additional costs being unsustainable in terms of size, type of structure, strategy, and sunk investments in the production systems.

New skills for the green sector

The automobile industry is a sector with mainly blue-collar employment, around 90% (Miranda et al., 2012); however, the skills base is changing as vehicles become more sophisticated and demands for quality become more stringent. Therefore, production requires new skills – for example in software competencies, in fitting and testing electronic components, in using robots or process controls. A number of particular skills needs are in the design and development of electronics and in the software to integrate different systems. Skills shortages do pose recruitment problems for the smaller companies in the supply chain.

Weaknesses emerging here mainly concern the following aspects:

- Smaller suppliers, ranking lower in the supply chain, are threatened with competition from low-cost locations
- Difficulties arise in recruiting the skills needed for the future – especially in the smaller supply companies.

Training needs for the green economy are not very different from the needs in the traditional economy; specific green skills development is not high in the firms' training and skills needs. Other more generic skills seem to be more useful for the green economy.

The OECD surveys on "Leveraging Training and Skills Development in SMEs" and "Climate Change, Employment and Local Development" found low levels of demand for specific green skills training. When asked '*What formal education training have you or your staff undertaken in the past 12 months?*', few respondents confirmed having had formal training on green skills.

This confirms that specific "green skills" are generally still not considered as a pressing need for firms. Training in this field remains underdeveloped.

The aim of the GREEN STAR project is to contribute to dealing with these persisting difficulties, considering that there are two reasons explaining for this

low level of demand for training in green skills. On the one hand, the limited availability of green training services in the market makes it difficult for businesses to find the right training. On the other hand, the difficulties for VET firms and trainers to design curricula that are relevant for businesses in their adjustment process also plays a role in explaining this low participation in green training. Some new jobs will be created, some jobs will be lost and many jobs will be restructured involving the upgrading of existing skills.

A significant research study (Miranda et al., 2012) shows that among the specific green skills requested from a company's staff, the top of the list requirements concern knowledge about certification procedures and standards (81.5%), followed by waste and energy problems (75 % for both), which take the lead on the other specific skills requirements.

Another specific comment concerns the "top" designer levels (EQF levels 6-7-8), whose basic competencies need to be updated with design for environment skills (DFE), in addition to the already developed competencies in design for assembly and design in manufacturing (generally referred to as DFx).

Design for environment skills (DFE) is important because 70% of costs of product development, manufacturing and use are decided in the early design stages.

The major issues to be taken into consideration already in the design phase, i.e. competencies to be developed by industrial designers mainly concern:

- Functionality and performance (the product must do the job)
- Manufacturability, logistics (one should be able to make the product)
- Reliability, safety (there must be some quality standard).

The design for environment or design for sustainability (DFS) ensures that the needs of both the business customer and society are met while protecting the ecosystem.

DFE / DFS can be further specified as design for recyclability, design for energy efficiency, design to minimize material usage, design for durability, and design for energy efficiency (Mayyas et al., 2012).

New skills for new supplier roles

The different types of suppliers, their position in the production chain implies not only differences in technological competencies, but also to the types of environmental impact.

In other words, not all suppliers are equal with respect to the need for green skills (Veloso et al., 2000). They can be basically distinguished into the following categories:

- Systems Integrator: Suppliers capable of designing and integrating components, subassemblies and systems into modules
- Global Standardizer – Systems Manufacturer: Company that sets the standard on a global basis for a component or system. These firms are capable of the design, development and manufacturing of complex systems ('black-box' design)
- Component Specialist: A company that designs and manufactures a specific component or subsystem for a given car or platform. These can include "process" specialists

- Raw Material Supplier: A company that supplies raw materials to the OEMs or their suppliers.

During recent years, development capability emerged as the critical issue differentiating supplier roles. Product proliferation and the incorporation of more technology in motor vehicles generated the need to disperse development efforts throughout the supply chain. As a result, OEMs and first-tier suppliers make a detailed assessment of the development responsibilities that smaller suppliers are capable of accepting. This means that suppliers are asked not only about their production capability, but also about organisational and design capacity especially.

Another aspect related to new training skills derives from the evolution of technology both for green production (e.g. electric cars) and for the improvement of traditional products (e.g. conventional fuel-powered cars). These new requirements demand not only green skills, but also new competencies with respect to new materials, technologies etc., as the technological range of a car is extremely complex. The theme of the new technical and production trends is of huge extent, evident in the relevant literature. A summary analysis which is suitable for the goals of this paper is suggested in the study conducted by Phaal (2002), an expert of roadmaps, who develops the following five road mapping topics:

- Engine and Powertrain
- Hybrid, Electric and Alternatively Fuelled Vehicles
- Advanced Software, Sensors, Electronics and Telematics
- Advanced Structures and Materials
- Design and Manufacturing Processes.

To sum up, we need new skills

- For a general green culture;
- For new technologies for traditional manufacturing, indirectly for green (KPMG International, 2010);
- For new technologies for new green products;
- For new materials;
- For more widespread regulation;
- For new design criteria (design for environment, new modular product architecture and platforms);
- For new production processes (Industry 4.0).

Although debate on sustainable development was generated in this context giving great emphasis to economic aspects, for many years the management perspective on this topic has been practically ignored. The awareness of a long-term non-sustainability of current development models is a relatively recent conquest achieved because of increasing difficulties of access to resources once considered unlimited or available in great abundance to the extent that they have become a global problem.

So, "alla fine della giostra" as we say in Italy (at the end of the day), GREEN is beautiful but cost is the final benchmark used by car makers to choose among potential, more or less green suppliers.

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3
The GT VET Blueprint[15]

Antonius Schröder

The *Greening Technical Vocational Education and Training* (**GT VET**) project has explored how vocational education and training (VET) pathways meet *environmental* skill needs, which are key for the global competitiveness and sustainability of all European production industries. As a model, the industry driven European sustainable training module was developed in correspondence with national VET systems.

Using the example of the steel industry and the VET of mechanical and electrical technicians, the module and its implementation process are a blueprint to be adapted and transferred to other technical VET professions and other production industries, in this case the automotive supplier industry.

3.1 The General Framework and Development of the GT VET Training Module

The GT-VET project required a clear definition of green skills (based on the definition in chapter 2.2). This definition was formulated as bottom-up to reflect the specificity of the steel sector and top-down in order to incorporate wider 'green' policy imperatives (such as those deriving from EU strategies and regulations, e.g. EU 2020).

Green skills for technical VET of the European industry:

- Are technical skills and appropriate awareness for environmentally sustainable behaviour
- To prevent and reduce negative impacts on the individual and environment (neighbourhood, employees, air, water and ground)
- Caused or initiated by operations and work in and around production.

[15] This chapter is mainly based on chapter 2 of the GT-VET Training Handbook (Schröder and Kaletka, 2013).

The development of the training module was carried out as a kind of social innovation process (see e.g. Howaldt and Schwarz, 2010; Schröder 2012; Howaldt et al. 2014) combining the knowhow of research institutions with a strong practical involvement of steel companies, accompanied by European social partners and the involvement of VET system relevant associated partners (vocational schools, national and regional stakeholders).

In a first step the impact of ecological legislation in everyday work of skilled workers both for today and future was analysed as well as each national VET system of the participating member states. With each VET system having different regulations and institutional frameworks, an analysis of the existing curricula of the chosen apprenticeships and regulated professions (industrial mechanics and electrical technicians) and its implementation possibilities for the identified skills were done. Clearly, there are a varied set of curricula, policies and practices, which is indicative of different levels of skills, competence and knowledge across the case study countries.

The concrete realisation of VET in the different training venues has also been investigated – interviews and workshops with the training department in steel companies (target group: trainers), environment and other technical departments, e.g. health and safety (target group: managers), recently graduated apprentices, vocational schools (target group: teachers), the chambers of industry (representatives of VET), and other VET relevant institutions at regional level provided this information.

Against this background the European training module GT-VET had been developed as a comprehensive "continuous progressing training module" of all participating and further interested steel companies. It helps to keep the qualification of the (future) technicians up-to-date and up-to-future and to stimulate the short term implementation in the national VET systems. Four sub-modules were piloted in all participating steel companies and related VET institutions on the regional level. In accordance, the product was adapted and modified to fit the requirements of both the companies and member states as well as possible.

Finally a European Framework Module on Green Skills was set up, run by ESTEP (the European Steel Technology Platform), as a basis for continuous adjusting of the existing module against the background of new green skills demands as well as a blueprint for other industrial occupations and sectors.

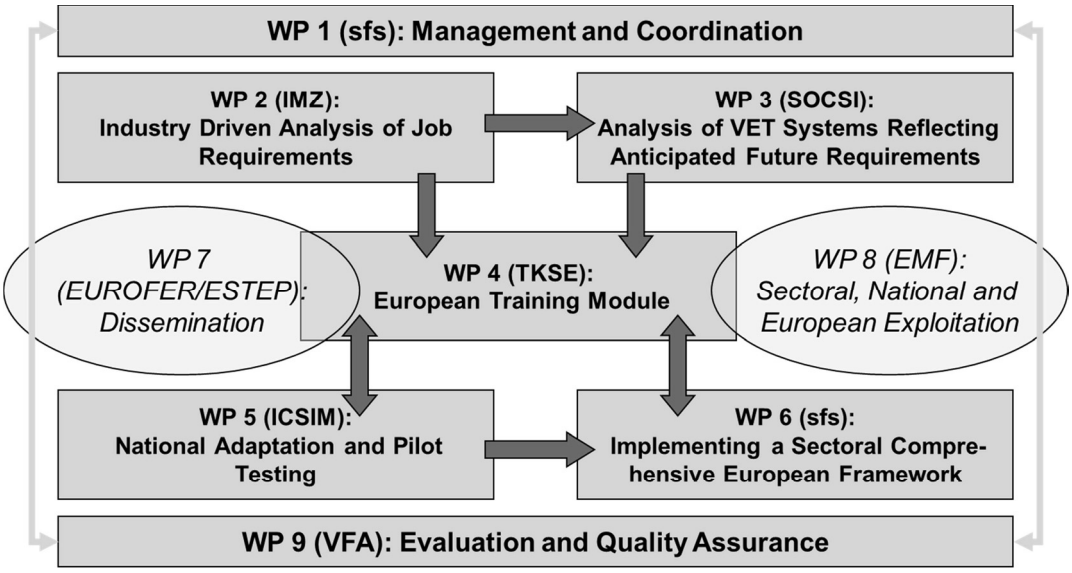

Figure 5 Work Flow of GT-VET

As the GT-VET module was developed with and for big companies, it was grounded on an already evident and high *awareness and responsibility for environmental issues* within the companies: e.g. ThyssenKruppSteel Europe (TKSE) plants have installed their own environmental representative. A common "culture" of shared responsibility regarding environmental issues is aimed at as well as skilled workers becoming increasingly considered as responsible for "green performance".

Environmental regulations influence basically every maintenance routine; for example, they are extensively integrated in VET and further training, plant protocols and operational instructions at TKSE. In addition "green projects" which aim at improving environmental performance are undertaken. Training increasingly resembles everyday work (integrative learning approach, autonomous problem solving and reflection as pedagogic concepts gaining importance).

VET Reflection on Industry Driven Requirements

Wider recommendations, found to be common to a number of cases, were that there should be a greater level of co-operation between companies and schools/colleges on (green) skills development, so as to ensure a clear, coherent and consistent message. In particular, school content must be relevant, specific and applied to company practice. Further, it is important that in-company training programs are reinforced by wider campaigns and information distribution.

In terms of module delivery, a series of smaller sub-modules was postulated to be run over the course of the apprenticeship training. The main consideration was that such training should be applied and role-specific, with numerous examples of concrete learning provided, and supplemented by the use of projects and applications of tools, such as life cycle or production process assessment. It was also suggested that critical incidents could be documented and form the basis for analysis – students could work out what went wrong in a situation and how it could have been prevented through the identification of the appropriate actions at each stage. These are deemed to be essential for effective learning by the trainees themselves. Emphases on consequences of behaviour – the 'why' as well as the 'what' – and the implications for individuals, the organisation and society have to be included also.

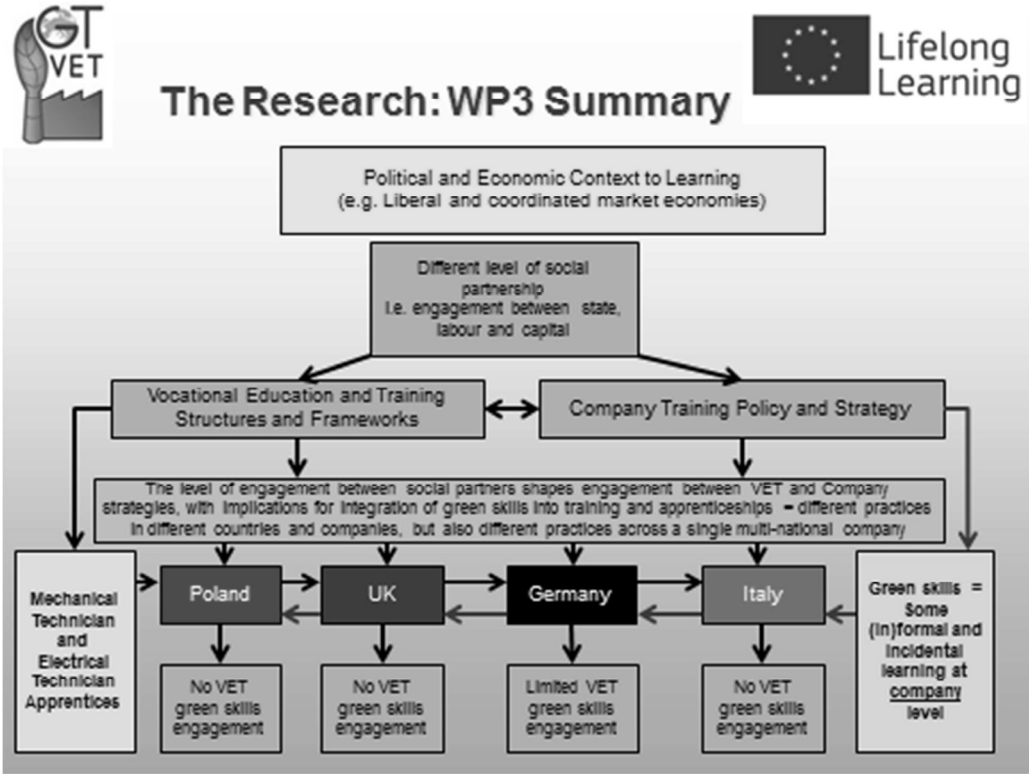

Figure 6 Company demands and VET system reflection

Training Module Development

The training departments of the companies, representatives from vocational schools and not at least the trainers, teachers trainees themselves (in every involved member state) strongly advised the consortium to produce a training module with concrete relevance to the workplace, not only giving information and inputs but setting active tasks to the trainees.

Based on the research results concerning company demands and VET system reflections the module:

- Raises more awareness of the workers on environmental and related health and safety issues
- Allows the companies to offer their apprentices and employees the "green skills" training module in a flexible way, including face-to-face learning situations and self-conducted projects
- Is structured in such a way that it can be simply and flexibly integrated into each VET national system or used in addition to the existing system of VET (by matching the demands of industry with the VET system)
- Is thematically differentiated in four sub-modules: energy reduction, use of raw materials, re-use of waste, and reduction of noise
- Addresses learners on different subsequently following learning levels (basic information, background and coherences, professional practical knowledge/ competencies, process know-how).

3.2 Sectoral European Training Module on Green Skills as a "Blueprint"

A sustainable implementation and further development of the training module as well as the continuous integration of industry demands for green skills on the background of a European future standard of green awareness and skills for the production industry were some of the main objectives of GT VET.

The GT VET training module on green skills and its learning methods fit to other learning contents, methods and phases of the general vocational education and training programmes:

- In the companies: Could be implemented in the regular apprentices programme of the sites
- In the vocational schools: Could be used as a practical example of the steel industry and electrical and mechanical technicians for education of other technicians and production industries.

The sub-modules energy, waste and noise can be introduced easily into secondary and technical schools as well. From a (vocational) school perspective, the module is particularly appropriate since in the final exams (for instance of the chambers of commerce and industry in Germany) the environmental awareness of students has become an important evaluation criterion (e.g. sustainable use of materials). Although many trainees attend various courses they aren't aware of issues of environmental awareness in context of the subject (electrical/mechanical technician) because it is not explicitly mentioned in the descriptions.

The main findings of the test phase show that the GT VET module is a link for the short-termed reaction to technological changes. The topics and didactic methods are approved, effective and attractive – also in a sense of increasing

ecological awareness and green behaviour both at workplace and in private life. The practical knowledge obtained in the module was evaluated very highly, the content is important for the professional work of trainees. The module offers valuable exercises as well as methodological teaching solutions (variety of individual and group work, presentation of results obtained during group work to the rest of the group); the interactivity of the theoretical inputs could be improved by media based inputs (video, animations, etc.). The module is deemed necessary to train the partial lack of green awareness and will increase "green" awareness of production processes and work processes in the company in the future.

The flexibility of the module (different sub-modules, learning/knowledge levels) is shown by its possible combination with integration in different learning arrangements, time schedule and content arrangement – for both educational and training programs/curricula of companies and the VET system.

All in all, the GT-VET module fits to the education and training program of companies and schools and creates a clear added value. The module (and its sub-modules) improves through its work place relevant practical knowledge and the activity based approach the awareness and skills for environmental awareness through self-reliant work, reduction of resources and money saving.

- The teaching and learning model or profile could be a good image for new teaching and learning profiles encouraging “green” activity and responsibility of the learners/trainees/workers.
- By stressing explicitly this background the trainees and the trainers voted for an integration of these kinds of modules in the traineeship.
- The trainers (steel company) and teachers (vocational and secondary schools) could use (relevant parts of) the training module in their regular training program (even for continuous training).
- The developed GT VET training module is a link for the short-termed reaction to technological changes and responsive integration of work place related new skills demands in vocational education and training in both company training and VET system.
- Therefore, a (much more) closer level of cooperation between companies and vocational schools in Initial VET is necessary.

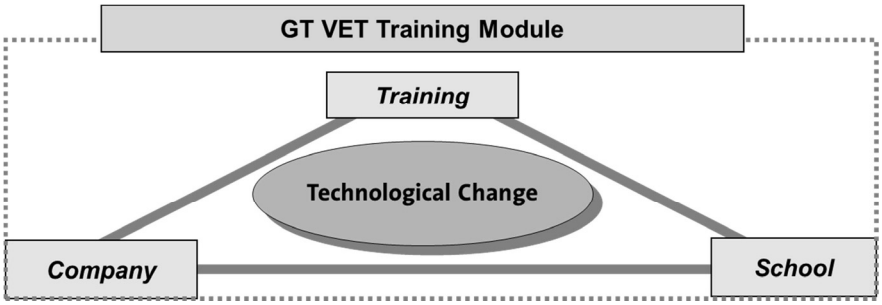

Figure 7 GT VET Training Module as a Link between Training/Education, School and Company

3.3 Methodology of the Training Module

Based on a precise definition of green skills being relevant for GT VET in the steel industry an activity based learning approach with four thematic sub-modules was generated, each consisting of four subsequent and increasing learning levels.

The training module is defined by learning outcomes, including both non-formal and informal learning oriented at knowledge, skills and competences (EQF), with the main focus being on competences (ability to use knowledge and skills with self-responsibility and autonomy).

The module (represented by different sub-modules) aims to improve the knowledge and awareness of the target group on environmental issues of the steel industry. Evidence suggests that there is little awareness and interest in 'green' issues. The objective for the training is to increase engagement and motivation in this area.

The training improves awareness for green skills through:

- Theoretical inputs and self-organised learning, group and project work, ability to critically check existing situations, planning and management of project, presentations
- Focusing on the workplace experience, implications
- Self-directed learning
- Improvement of context knowledge, comprehensive approach for learning and training, generic understanding, identification of parameters for change.

There is potential for the programme (as a whole, or as individual sub-modules) to fit with company delivered programmes or wider VET frameworks. One aspect under consideration is for the module programme to be accredited through the European Credit system for VET (ECVET).

Activity based learning approach

Based on the results of the industry requirements and its reflection on the VET systems, an activity oriented learning approach for the European training module was developed as a workplace and activity based learning sequence (with smaller sub-modules and action-oriented green skills projects) supported by digital media (e.g. power point-presentation for teachers, videos). For the pilot version principal environmental concerns that derive from the steel production process were identified as sub-modules (energy, raw materials, waste, and noise) and developed in new or enriched existing projects with green aspects. The module shapes knowledge, abilities and attitudes in broadly understood green awareness. Learning outcomes were defined to be tangible and raise awareness. The content is workplace related and relevant for steel production and its further processing. Cognitive and manual learning, as well as learning by doing, were combined, useful work pieces which foster sustainable learning being created and learning becoming action oriented. A set of didactic methods were incorporated in the module to facilitate the knowledge transfer and spice up learning process. The more complex didactics are they were oriented towards

activities. Learning impact was based on critical events (including which kind of misconduct led to negative impacts). Beneath practical parts all contents are convenient to be used at different learning facilities (school, company work place, training areas). The module promotes cooperation between all learning venues (vocational schools, training centres, production sites).

Matrix of learning areas and levels

The main topics (energy, raw materials, noise and waste) deriving from the actual demands of the involved companies were developed in sub-modules of four different learning or knowledge levels (see the following figure). These levels are following subsequently from each other, improving the level of self-learning and learning outcomes step-by-step. The specific learning contents and activities are oriented at typical situations and matters close to the workplace and company requirements. Each level of each sub-module develops knowledge to a deeper (and more industry relevant) level. While level 1 and 2 are more input oriented (with self-learning and group work as well), especially level 3 and 4 are based on own activities, tasks and projects of the trainees.

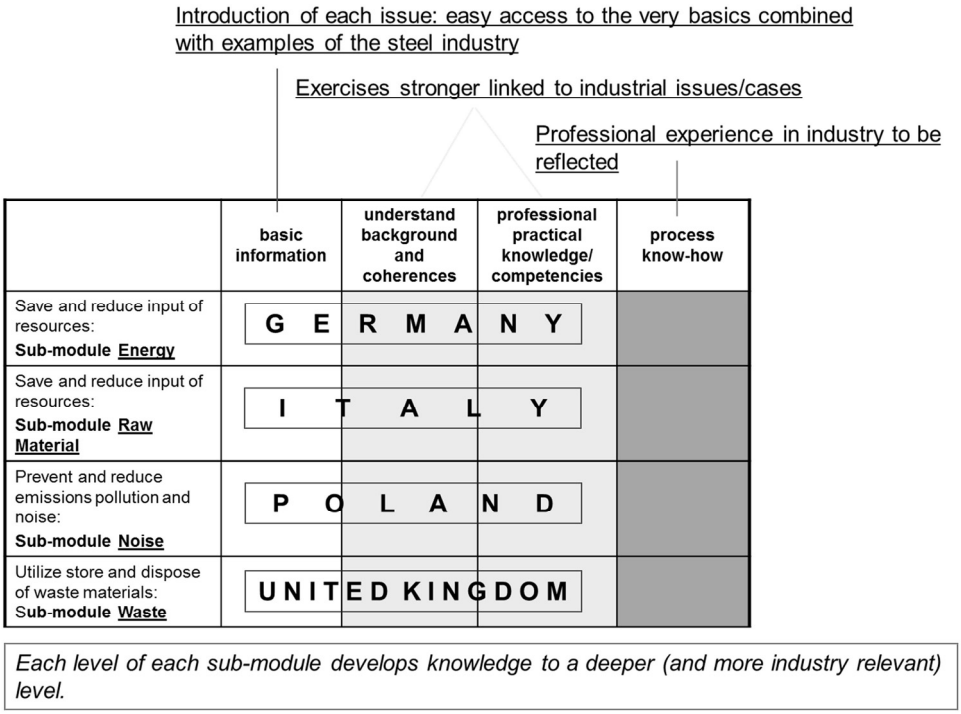

Figure 8 GT-VET Sub-modules and Learning Levels

The content of the different learning levels within the different submodules are summarised in the following table.

Level 1: Basic Information
• General introduction into the issue taken account of examples form the steel industry (between 5 to 15 pages) – definitions – using examples – e.g. to use for self-learning – technical background is not needed
• Easy exercises for singular or group work – related to personal experiences – to reflect surrounding world – to scrutinize everyday occurrences – to exchange personal experiences in a learning group – to show that this issues is relevant for everybody – discussion of results could be a starting point for a wider discussion
Level 2: Understand Background and Coherences
• Exercises are more complex than in 1st level • Needed information has to be self-searched (papers, document, internet etc.) • Results have to presented and explained by learners • Exercises are linked to industry • Exercises should work out in group • Encourage to discuss the results
Level 3: Professional Practical Knowledge/Competencies
• Practical exercise for technical apprentices in an industrial workshop or technical training centre • Exercise should cover a short but complete work process (from planning to evaluating the process) • Get in contact and understand needed industrial guidelines for the exercise • Understand how the exercise is linked to the GT-VET issue • Intensify search-work and presenting work
Level 4: Process Know-how
• Reflection of a practical phase of skilled work in a steel company • Understand green aspects of production (What do they do for environmental protection in the plant part where I am working) • Reflect environmental guidelines, instructions relevant for a specific working process • Knowledge about specialized contact persons in a plant part (environmental protection officer, safety protection officer, hazardous substances officer etc.) and their essential functions

Table 1 Learning Levels of GT VET

Target groups

While the sub-modules "Energy" (Germany, TKSE) and "Waste" (UK, TataSteel) are quite similar in the target group and learning place orientation and in line with the GT VET targeted professions electronic and mechanical technicians, the sub-module "Noise" (Poland, ArcelorMittal Poland) was at level 1 and 2 targeted at students of middle and technical schools, but the contents are easily transferrable to training with apprentices and workers. The sub-module "Raw Materials" (Italy, AST) is quite different, because the qualification level is rising from level 1 (unskilled workers) continuously to top managers (level 4). Therefore this training sub-module could not be transferred to the other countries and companies and had to be improved for the European Framework Module.

Industry related main topics	**Level 1:** Basic information	**Level 2:** Understand background and coherences	**Level 3:** Professional practical knowledge/ competencies	**Level 4:** Process know-how
Save and reduce input of resources: **Sub-module Energy**	pupils / starting apprentices	apprentices (lower level)	apprentices (higher level)	professionals
Save and reduce input of resources: **Sub-module Raw Materials**	no previous knowledge	professionals	middle managers revised: professional workers	(top managers) revised: professional workers
Prevent and reduce emissions pollution and noise: **Sub-module: Noise**	middle school students	technical school students (higher than middle school)	workers	specialised workers
Utilize store and dispose of waste materials: **Sub-module Waste**	apprentices / students	apprentices / students	apprentices / students	apprentices / students

Table 2 Target Group Level within the Sub-modules (GT-VET)

Duration of the (sub-) modules

Each sub-module has a time scale of about 20 days, consisting of about 2 hour learning sessions on level 1 and 2, two or three days of practical tasks at level 3 and 10-15 days for the project based work of level 4.

Topics from GT-VET definition	**Derived contents**	**Level 1:** Basic information	**Level 2:** Understand background and coherences	**Level 3:** Professional practical knowledge/ competencies	**Level 4:** Process know-how	**total learning hours**
Save and reduce input of resources	**energy**	*2 hours*	*2 hours*	*3 days*	*15 days*	***about 20 days***
	raw materials	*2 hours*	*2 hours*	*2 days*	*10-15 days*	***about 20 days***
Prevent and reduce emissions, pollution and noise	**Noise**	*2 hours*	*2 hours*	*3 days*	*15 days*	***about 20 days***
Utilize store and dispose of waste materials	**waste**	*2 hours*	*2 hours*	*3 days*	*15 days*	***about 20 days***

Table 3: Duration of learning units (GT-VET)

Integration in national VET systems

Education and training of the companies are very much related to the different VET approaches and national systems:

- In Germany the dual system is dominating the education and training of the companies very much, even there is a strong emphasis on a closer integration or consideration of company related skills demands and practical orientation at the workplace (combining practical company related training with secondary vocational education) within the curricula of the vocational schools
- In the UK a strong training approach / orientation done by special sectoral skills councils and training institutions is visible (focus on vocational training)
- In Poland a school related basic learning (with a focus on theoretical input) is detectable for the first two levels of the training module

(basic learning, context understanding) followed by practical experience related inputs within the company and tasks at level 3 and 4 of the module
- In Italy a strong knowledge hierarchy is evident; each level is oriented at a higher worker level. This depends on the strong influence of the company, even in the development of the module.

But these different "cultural frameworks" should not be seen as constraints to integrate the related sub-modules in other national or company VET frameworks. On the contrary, these different approaches show the wide variety of integrating possibilities (verified through the test results in the other countries). Even the management orientation of the original Italian sub-module "raw material" shows that the managers have to be integrated in the development of green skills as well, e.g. taking the right decisions on the best available techniques (BAT) for a greener production process.

However, because the *formal* integration of such a training module in **national VET systems** could be a complicated and lengthy process the GT VET sub-modules (or parts of it) were designed to be easily and flexibly integrated in the national and companies related VET systems:

- In **Germany** it was done by using the given leeway of the existing curricula and the given learning targets of the analysed professions. The Dual System provides also the possibility of a close cooperation between vocational schools and companies
- In **Italy** all sub-modules can be integrated in the curricula of the schools due to their autonomy. According to the law, schools are allowed to modify up to 35% of their Education Plan to upgrade contents and methodology in the perspective to respond to new training needs coming from territory, companies and stakeholders
- In **Poland** integration with the national VET system could take place by inclusion into school programs, as part of ecological education and training. Also a strong cooperation between the steel company and the region encourages schools and pupils to implement industry related topics in the learning paths
- In the **UK** this will require the engagement of the sector skills council (SEMTA) and the involvement of the appropriate standards authorities.

However, the pilot test in the different steel companies and member states showed that the GT VET sub-modules or parts of it could be easily integrated in the companies training program and the national VET activities by given leeway or responsibilities. This includes the allocation of credit points within the European ECVET system or approach, based on the time scale and the learning level of the different sub-modules.

Evaluation of the Module

The final feedback of the trainees and teachers during the test phase showed that the knowledge and awareness of the target groups about environmental issues of the steel industry before the training was very limited. There was overwhelmingly no awareness, no interest and motivation concerning green skills. The engagement and motivation has to be raised by the trainers and the

concept of the training module, mainly by interesting tasks and the own activities of the trainees. During and after the training the module led to a high engagement of the learners, awareness was raised, enthusiasm could be testified. Especially by finding more efficient solutions on the work place (saving money, work place innovation), a new view on the production process and a change of conscience and behaviour (including the correction of behaviour by others) could be discovered.

The added value of the training module (based on the assessment of the trainees and teachers) is proved by:

- Focus on the workplace experience, implications
- Own responsibility, own project planning and conducting
- Improvement of context knowledge, comprehensive approach for learning and training, generic understanding, identification of parameters for change
- Fostering workplace innovation (bottom-up)
- Improvement of the existing cooperation between company and vocational school (on a new regular basis of cooperation: meetings twice a year, bilateral contacts);
- "Learn-learn-learn" situation for trainees, trainers/teachers, workers/management of involved production sites.

Consequently, the training module is improving the "green perspective" on production and work processes. It clearly raises awareness for environmental issues and "green" behaviour of the trainees, trainers and workers/management of the involved plants and production sites.

3.4 The Submodules

In this chapter the developed sub-modules of GT VET (energy, raw materials, waste, and noise) are described with their contents, organisational and didactics measures.

Different demands and priorities for green skills in the involved steel companies and the related national VET systems led to some European relevant similarities as well as national relevant specifications. Anyway, the sub-modules fit together very much: E.g. the "Waste" sub-module is of direct importance for the sub-modules on "Energy", "Raw Materials" and "Noise".

3.4.1 Energy

The sub-module "Energy" was developed in the way that its four learning levels could be integrated in the regular education and training program of the company and the vocational school within the German Dual System. Existing leeway within the official curricula (green skills are already part of the formal curriculum, but not enough considered, esp. from the perspective of company needs) were used for this integration.

Level 1 and 2: both professions (electrical and mechanical technicians) were taught together in a "class room"

Level 3 and 4: different tasks were conducted for electrical and mechanical technicians (but within mixed groups of 4 to 5 persons with electrical and mechanical technicians)

Level 4: took place on-site in cooperation with the workers and management of a specific production area (rolling mill).

Level 4 was created in a way that trainees learned much more about the workplace and the related production process. A win-win situation with the management and the workers of the production site was produced by getting a new perspective on existing structures through de-constructing and analysing existing processes.

The sub-module "Energy" could be easily connected to the other sub-modules of GT VET as well (waste could be used for energy production, noise reduction through energy reduction, etc.).

The following description of the training units are following the distinction of the four levels, first showing the actual unit within the whole training program and giving on overview of the learning contents and didactics. Then specific tasks are described.

	L.1: Basic information	L.2: understand background and coherences	L.3:professional practical knowledge/ competencies	L.4: process know-how
Title of the training unit	Forms and sources of energy	Energy sources, efficiency and saving	Calculate and measure energy consumption in a defined area and justify an economic solution	Saving energy at your workplace
Learning outcome	The apprentices/pupils distinguish between different forms of energy, esp. renewable and non-renewable sources, can explain their efficiency independently with a variety of presentation media	The trainees know different levels of energy and sort them to energy sources as well as they know possibilities to save energy	Apprentices could build a laboratory situation to measure several kinds of light, their energy consumption, their costs and the efficient way to use them. They could calculate capacity, efficiency and cost for a specific energy solution.	The apprentices / pupils could check possibilities to save energy at their workplace.
Background information required	No information required	Basic understanding of energy sources	Knowledge how to calculate and measure electricity.	Data sheets, company directives, practical industry experience
Approximate duration	90 minutes	90 minutes	3 Days	Depending on duration of internship/employment
Target group profiles	Pupils / starting apprentices	Apprentices	Apprentices	Professionals, professional apprentices
Learning process (didactical procedure)	Brainstorming, group discussion, group-work, individual work, own presentations	Raising awareness of use and saving energy	Complete work order: plan, realize, evaluate a project	Presentation reflecting industrial experience

Table 4 Sub-module Energy - Overview, Content and Didactical Measures

Level	Content	Didactical measures
L.1.	Definition of energy, energy conversion (with examples), sources of energy, renewable and non renewable energies, efficiency	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, conclude agreements, team work, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, results presentation 4. **Exercises**: look up, work out, explain and present main notions; match the energy sources to pictures; what is energy conversion for you
L.2.	Different forms of energy and distinction of them, renewable and non renewable energies	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, conclude agreements, team work, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, results presentation 4. **Exercises**: sorting levels of energy to energy sources; look up, work out, explain and present which energy sources are used where and for what purpose; saving resources – responsibility of trainees, politics, society and company
L.3.	Calculations of power, efficiency and costs	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, implementation of the task, conclude agreements, team work, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, results presentation 4. **Exercises**: housing lighting installation with regard to the most economic solution (electrical technicians); optimize a hydraulic system with a pressure-controlled vane-type pump (mechanical technicians)
L.4.	Experience-related competences, examples of energy savings in the plant	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, conclude agreements, to deliver and present information 3. **Methods**: tutor presentation; tutor led discussion, individual work, results presentation 4. **Exercises**: completing the form

L4. Examples and strategies where energy is saved and could be saved at the workplace (working area) have to be examined and presented. A worksheet helps to structure and prepare the presentation.

This sub-module can easily be incorporated into company training programs and VET institutions (for initial and continuous VET as well). It provides ample examples of delivery methods with examples and templates that could be used at individual and group levels. Furthermore, the approach is conducive to behavioural and overarching cultural change as the module requires trainees to consider energy savings within the work environment, with society, the home and for encouraging their colleagues. It also encourages trainees to calculate energy consumption and savings thus allowing allocation of responsibility which in turn increases understanding. Knowledge and awareness of the target group about environmental issues of the steel industry is improved by the training: High engagement, awareness raising, and enthusiasm rose especially by finding more efficient solutions on the work place (saving money, work place innovation), a new view on the production process, and change of conscience and behavior (including correction of behaviour of others).

3.4.2 Raw Materials

The training course on raw materials had the advantage of drawing the attention to the fact that the company pays on ecological issues. This reflection led to the specific goal of the company to develop new technologies and specific training courses. Because the current AST workforce has a low number of apprentices and, in most of the situations, they are not included in maintenance activities the responsible developer AST has chosen a higher qualified target group level for the sub-module "Raw Materials" than the supposed electrical and mechanical technicians:

- Workers and employees of the production areas whose activities impact on the environment, and who have responsibility for the job training of other operators
- Employees of the production and staff functions who are responsible for the choices and the study of new technologies and methods that can be able to suggest new plans and new technologies
- Personnel with decision-making skills and responsibilities, who have the abilities to evaluate the selection of new technologies.

The general objective of the sub-module was to develop and strengthen the awareness of the impact of a steel company on the environment, and how to limit this impact through the levers of principal business processes.

The concrete objective for the Raw Materials sub-module was to get a general idea of the steel production stages which have a greater environmental impact and to help saving and reusing raw materials.

The sub-module "Raw Material" is more theoretical than the others, but heavily improved by more practical tasks and tests. It is about the sustainable usage of raw materials in the steel industry, focused on the handling of scrap and slag and, above all, its recycling in order to reduce the environmental impact. The optimised use of raw materials for the production of stainless steel is explained at the **Electric-Arc Furnace (EAF)** process of Acciai Speciali Terni (AST). A close

relationship to the sub-module "Waste" and the European Waste Directive (1975, No. 442) has to be mentioned.

Objective of this sub-module is to show how an optimised use of raw materials could be a basic condition for the steelmaking process to be both cost-efficient and eco-friendly.

On level 1 the reduction of environmental impact in the steel production and the role of raw materials and energy are described. Level 2 illustrates the stainless steel production with the EAF process and the use and reuse of scrap. The use and reuse of steelmaking byproducts (mainly slag) and scrap and life cycle aspects are the main topic of level 3, whilst level 4 is dedicated to the analysis of the learners on the identification and the use and reuse of raw materials in the production process of the company subjects.

	L.1: Basic information	L.2: understand background and coherences	L.3:professional practical knowledge/ competencies	L.4: process know-how
Title of the training unit	Raw Materials in the Steel Production	Steel Production Process (in relation to raw materials reuse)	Steel Production Process (in relation to raw materials)	Identification of raw materials and their reuse
Learning outcome	Initial understanding of raw material and its usage in the production process	Knowing how electric furnace production process works and raw materials are used within this process	Knowing how slag and scrape is (re)used in the production process, describing a life cycle of raw material	Be familiar with production cycle in the steel plant, ability to the (re-)use of raw material in the company
Background information required	No information required	Information from L.1.	*Information from L.2.*	Information from L.3.
Approximate duration	90 minutes	90 minutes	2 days	5-15 days depending on the complexity
Target group profiles	Students or apprentices with vocational school degree and no work experience	Professional degree, max. two years of practice in the company	Professional degree, max. two years of practice in the company	Professional degree, more than two years of practice in the company
Learning process (didactical procedure)	Lecture, group discussion exercises, test	Lecture, group discussion / work, test	Group/team work, undertaking a given task	Conducting an on project analysing the production process in the company under the perspective of the use and reuse of raw material

Level	Content	Didactical measures
L.1.	Raw Materials in the Steel Production	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, conclude agreements, team work, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, results presentation 4. **Exercises**: look up, work out, explain and present main notions; what are raw materials, listing raw materials;
L.2.	Steel Production Process (in relation to raw materials reuse)	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, conclude agreements, team work, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, results presentation 4. **Exercises**: look up, work out, explain and present which raw materials are used where and for what purpose; saving resources – raw materials
L.3.	Steel Production Process (in relation to raw materials reuse)	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, implementation of the task, conclude agreements, team work, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team work, results presentation 4. **Exercises**: Raw materials and their life cycle: the hammer tool example
L.4.	Identification of raw materials and their reuse in the workplace	1. **Trainer input**: lecture, lead discussion 2. **Trainee behaviours**: listening, active participation in exercises, looking up, collecting and filtering information, conclude agreements, to deliver and present information 3. **Methods**: tutor presentation; tutor led discussion, individual work, results presentation 4. **Exercises**: completing the form, checklist

Table 5 Sub-module Raw Materials - Overview, Content and Didactical Measures

3.4.3 Waste Materials

The sub-module "Waste" was developed in the UK and has a highly relevant content and a sound range of learning methods deployed, logical fit with all the other sub-modules ("Energy", "Raw Materials" and "Noise"), covered at college (induction) as well as onsite. Compared with the legal situation of waste legislation in other countries, a modification to the national situation is necessary, but an implementation of the UK-version is not considered as problematic. For instructors/trainers two primary goals were important: Creating

first awareness of trainees in order to mediate in-depth knowledge, even if they are trained in different disciplines or will work in various fields after their apprenticeship; secondly, it is not just a matter to impart knowledge, but also to achieve a change of mentality.

A critical remark has to be made to the term “waste”. Ultimately, the whole production process is a cycle in which *all* substances are discharged and must be recycled. Taking this into consideration, there is no “waste” anymore but materials to be recycled (see the concept of a circular economy, described in chapter 2.1.2). Consequently, this term is outdated or misleading in terms of new technologies and legislation.

The module was deemed necessary to train the partial lack of awareness of waste materials by trainees through practical projects. To integrate the module into the apprenticeship various training structures are possible. One suggestion is to start with the basics in the first year, to impart the next two levels in the course of the training and at the end of the training to carry out a project. This is to consolidate the principle "from simple to complex content", the general “philosophy” of GT VET. Furthermore, it is also possible to complete the first two levels in vocational schools and anything else on the operational stage. In addition, during the fourth level new company related project tasks should be set out to cope with current operational problems.

In this context tangible measurement and documentation of changes are non-negligible elements. As a result it helps to show trainees in a transparent way how their behaviour may affect the production maintenance process, e.g. within a project. This causes – as not only the experience of GT VET shows - a greater awareness as purely theoretical training.

Table 6 Sub-module Waste - Overview, Content and Didactical Measures

Level	Content	Didactical measures
L.1.	Definitions, commonly used terms (e.g. scrap), characteristic of waste, waste types, waste production statistics, how waste arises in the manufacturing process; how individual activities can influence waste generation	1. **Trainer input**: preparing Course Materials, lecture, lead training 2. **Trainee behaviours**: listening, active participation in team/individual work exercises, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, individual computer based tasks, results presentation, multiple choice quiz 4. **Exercises**: key steps in any manufacturing process with aim to identify places of waste producing
L.2.	Resource depletion, accidental or inappropriate waste release, ladfill impacts, incinearation impacts, measures for mitigation of these issues	1. **Trainer input**: preparing Course Materials, lecture, lead training 2. **Trainee behaviours**: listening, active participation in team/individual work exercises, presentation of the results 3. **Methods**: tutor presentation; tutor led discussion, team and/or individual work, individual computer based tasks, results presentation 4. **Exercises**: waste impacts activity
L.3.	Recap of sources of waste, assessment of whether a material is a substance or a waste, Duty of Care documentation	1. **Trainer input**: preparing Course Materials, lecture, lead training 2. **Trainee behaviours**: listening, active participation in individual work exercise, presentation of the results 3. **Methods**: tutor presentation; individual work, results presentation 4. **Exercises**: fill in example of obligatory waste document
L.4.	Introduction to the basics of waste mapping, use site map to plot: type of waste, location, quantity, disposal costs; consider all sources of waste; site walkabout and audit; identify sources, identify types and current stats	1. **Trainer input**: preparing Course Materials, lecture, lead training 2. **Trainee behaviours**: listening, active participation in individual work exercise, presentation of the results 3. **Methods**: tutor presentation; individual work, results presentation in written report 4. **Exercises**: student project

	L.1: Basic information	L.2: understand background and coherences	L.3:professional practical knowledge/ competencies	L.4: process know-how
Title of the training unit	What is waste	Waste – Legal Requirements	Waste produced in the workplace	Waste Auditing, Mapping & Minimisation
Learning outcome	Students will be able to: define waste and understand how waste is created; understand, define and use correctly basic waste terminology, understand categories of waste and waste hierarchies	Students will be able to: understand the impacts of Waste, understand how the impacts of waste are controlled – Duty of Care, understand how the impacts of waste are mitigated or reduced	Students will be able to: identify the types of waste that are generated through mechanical/electrical maintenance work, describe the disposal requirements for each type of waste and to understand processes of safely and accurately disposing of generated waste, understand how to accurately complete required records	Students will be able to: evaluate and understand how to apply, the principles of the waste hierarchy to the work area, understand how to make recommendations as to waste minimisation/improved management in work area, understand the steps involved in a waste audit
Background information required	No information required	L.1 – Basic Information	L.2 – Background and Coherence	L.3 – Professional Practical Knowledge
Approximate duration	120 minutes	110 minutes	60 minutes	Duration of the course
Target group profiles	Apprentices and students	Apprentices and students	Apprentices and students	Apprentices and students
Learning process (didactical procedure)	Lecture, team-work, individual activity, quiz to test knowledge	Lecture, team work	Lecture, practical exercises, case studies	Lecture, project work

3.4.4 Noise

Background of the sub-module "Noise" is that noise is an underestimated emission and harm, especially in the production area. Within GT VET it hardly constitutes a conscious perceived issue for the trainees and workers in the companies. This was due mainly to the lack of awareness; even though such noise protection areas in the works are clearly marked and strict noise, health and safety regulations are applied. In addition, the responsibility to act environmentally conscious is lower than with waste and energy conservation. But overall, it became clear that a greater awareness must be created regarding to the issue of noise in an environmental context.

The approach for the sub-module is a bit different because it addresses secondary and middle/technical school student (level 1 and 2), while level 3 and 4 are company related trainings. However, the contents of level 1 and 2 could be easily transferred to in-company trainings as well. The module was also considered because noise is a commonplace tangible measure (e.g. through decibels, vibration of equipment), and project work and exercises on level 3 and 4 are possible (e.g. strategy development to reduce noise).

Table 7 Sub-module Noise - Overview, Content and Didactical Measures

	L.1: Basic information	L.2: understand background and coherences	L.3:professional practical knowledge/ competencies	L.4: process know-how
Title of the training unit	What is the noise, key issues	Noise in general - to prevent and reduce	Noise nuisance	Rating industrial noise - practical aspects; acoustic protection and specialized issues of noise in the workplace
Learning outcome	The trainees distinguish between sound and noise, know noise effect and its harmfulness in general	The trainees know fundamentals of acoustic, understand the phenomena of hearing, know damages of hearing and how to protect the hearing	The trainees know the sources of industrial noise, esp. in steel plant, harmfulness of noise, law requirements for noise emissions, application of PPE (personal protective equipment)	The trainees know health and safety requirements for noise, noise measurement methods at workplace, occupational risk assessment, effects of exposure to noise, methods to reduce noise emissions
Background information required	No information required	Information from L.1.	Information from L.2.	Information from L.3.
Approximate duration	45 minutes	45 minutes	45 minutes	45 minutes
Target group profiles	middle school students	students of technical schools	workers admitted to the Company	specialists in the Company
Learning process (didactical procedure)	Lecture, group discussion exercises	Lecture, group discussion exercises	Lecture, group discussion exercises	Lecture, group discussion exercises

	L.1: Basic information	L.2: understand background and coherences	L.3:professional practical knowledge/ competencies	L.4: process know-how
Title of the training unit	What is the noise, key issues	Noise in general - to prevent and reduce	Noise nuisance	Rating industrial noise - practical aspects; acoustic protection and specialized issues of noise in the workplace
Learning outcome	The trainees distinguish between sound and noise, know noise effect and its harmfulness in general	The trainees know fundamentals of acoustic, understand the phenomena of hearing, know damages of hearing and how to protect the hearing	The trainees know the sources of industrial noise, esp. in steel plant, harmfulness of noise, law requirements for noise emissions, application of PPE (personal protective equipment)	The trainees know health and safety requirements for noise, noise measurement methods at workplace, occupational risk assessment, effects of exposure to noise, methods to reduce noise emissions
Background information required	No information required	Information from L.1.	Information from L.2.	Information from L.3.
Approximate duration	45 minutes	45 minutes	45 minutes	45 minutes
Target group profiles	middle school students	students of technical schools	workers admitted to the Company	specialists in the Company
Learning process (didactical procedure)	Lecture, group discussion exercises	Lecture, group discussion exercises	Lecture, group discussion exercises	Lecture, group discussion exercises

3.5 GREEN STAR Adaption, Modification and Extension of the GT VET Blueprint

Generally planned and seen as a blueprint for other industrial professions and sectors the challenge is to transfer and further develop the GT VET training module and concept to the automotive suppliers industry within GREEN STAR. It is a challenge because it is a change from a **global** and **large scale** industry (and single production companies of the steel industry) to **small and medium sized regional enterprise clusters and value chains**.

GREEN STAR has a very different and more heterogeneous background for the development activities involving science, regional authorities (municipalities/chambers), companies and training institutions as well as the European Vocational Training Association.

Together with the relevant partners of GT VET the Focus Group I of GREEN STAR delivered the essential context for the development of the GREEN STAR automotive suppliers training module.

Based on the Automotive Cluster Driven Analysis of Giovanni Bernardi (University of Padua) it became evident, that

- Green skills are no apparent topic, especially in the blue collar sector in the cluster
- Human resources in general are seen as critical (skill shortages, updating of skills)
- Main dimensions for green skills are: energy reduction, transport, materials, emissions (air/water), waste, recycling.

The main challenges are derived (as mentioned before) from the very different industrial and production background of the automotive suppliers and the given supply chain production. In general the "**SME culture**" is very different to the resources and possibilities of big global companies, mainly characterised by limited and specialised personnel and knowhow resources, a more reactive than proactive personnel development as well as by an on demand (technological) development.

Another challenge is the value/production chain and the different companies, specialised on different parts for the automotive assembling, different technologies and production processes. This makes it difficult to develop "one size fits all modules" guaranteeing equal standards for all the companies.

Drawn deductions of the cluster analysis for the module development are:

- concern about awareness rising of the companies and the workers for green skills
- a clear orientation at the cluster perspective and value chain
- a demand driven "learning chain"
- a consideration of the impact on the (regional) VET systems
- an integration of the assemblers perspective.

Therefore the GREEN STAR module development became a cluster driven and coordinated training approach with companies of the regional clusters integrating module improvement. The contents of the module are demand driven by defined prior environmental issues and recent practical requirements.

Awareness raising and specific didactical and pedagogical measures were improved on the basis of the GT VET module.

GREEN STAR Approach: SME Cluster Related Development Setting

Main EU recommendations for vocational education and training are delivering the general basis for the module development of GREEN STAR, such as improving company competitiveness by work based learning to increase workplace innovation (Cedefop, 2011).

The particular module development and improvement takes part on the background and under participation of the regional clusters of small and medium sized enterprises, characterised by a heterogeneity concerning the used materials, production processes, and end products. Therefore different occupations are also concerned leading to a concentration on transversal skills and the improvement of existing occupations by green skills. Concerning the cluster approach the management of the SMEs and regional authorities have to be involved; the end of supply chain (global companies) has to be encompassed as well.

GREEN STAR Approach: Motivation - Why?

The GREEN STAR approach refers to "green" as a relevant competitive factor and not as a "necessary evil". The awareness of green impact in the company is concerned not only under sustainability but cost-benefit aspects, an image improvement and other competitive advantages.

GREEN STAR Approach: Contents - What?

The different production processes of the company clusters will be in the focus of the GREEN STAR thematic sub-modules. The discussion of the main green issues of the automotive suppliers industry led to a selection and modification of two given GT VET sub-modules (energy and waste) and a new value and production chain related topic (life cycle assessment).

Three sub-modules of GREEN STAR:

- **Energy** (possibly including references to the ISO 50001) → modification of GT VET
- **Waste**
  → modification of GT VET
- **Life Cycle Assessment (LCA)**
  → new development.

The new sub-module LCA is strictly connected with the Energy and Waste processes management inside the company and will be described like the GT VET submodules under chapter 3.6.2).

GREEN STAR Approach: Framework - How?

A common framework for the modules was developed, based on the GT VET European Framework Training Module and the two chosen sub-modules relevant for GREEN STAR as well. This framework is characterised by an action and work based learning approach with specific green tasks and projects to be done within

the companies, built on adult related teaching and learning strategies ("andragogy"). Also the four subsequent learning levels were taken over.

The short-term updatable sub-modules could be easily used or adapted in the different automotive suppliers companies, for different production areas and workplaces and for different education and qualification levels.

The module concentrates on the recent and future company needs, developed by making use of multipliers (trainer, teacher, manager. etc.) in a (more) bottom-up and case study way when looking at the stable occupations of workers. Due to the regional cluster approach the regulation background will be considered and integrated.

Outline: Further Development of GT VET by GREEN STAR

In line with the results of the final European conference of GT VET (with VET stakeholders, social partners, the steel industry as a whole, and other relevant manufacturing industries attending) and the high level round table panel on "Green Skills Relevance for the Competitiveness of the European Industry" GREEN STAR is further developing the GT VET module. The panel participants from OECD/LEED, DG EAC, DG Employment, EUROFOUND, industriALL, ESTEP, and a Member of the European Parliament, Greens/European Free Alliance stated that this approach is the right concept for

- pushing green awareness with generic, specific, essential and transversal skills
- new ways of learning and training pathways off the classroom
- a flexible and easy integration into education and training programs, in schools/VET institutions and companies in addition
- sectoral and cross-sectoral cooperation between companies
- a responsive and short-termed integration of new skills - coming from continuously and rapidly changing (production) technologies - into the workplace, the shop-floor.

3.6 Life Cycle Assessment (The new GREEN STAR module)

Gabriella Bettiol, Chiara Salatin

Following to the results of the Focus Group I of the GREEN STAR project in Dortmund (Germany, June 2014) the stakeholders involved in GREEN STAR selected two submodules from the GT-VET blueprint, "Energy" and "Waste", and suggested to develop a **new sub-module "Life Cycle Assessment"** (LCA) considering its relevance within the automotive supply chains. The relevance of LCA also became evident by the green skills analysis of the automotive supplier industry (see chapter 2.2). Due to its novelty and the high relevance of LCA as an addition to the GREEN STAR training module (see chapter 4.4.4) the concept of LCA is first described in detail, added by an overview of the content, organisational and didactical measures (following the same structure like the already illustrated GT VET modules).

3.6.1 Life Cycle Assessment Method

Life Cycle Assessment (LCA) is an objective procedure allowing to quantify possible impact of a product or process on environment and human health, by the means of calculating energy consumption, emissions into the environment (air, water and soil) and generated waste, and identifying the used materials.[16] This assessment covers the whole product life cycle, including the extraction and processing of raw materials, the manufacturing, transport, distribution, use, re-use, recycling, and final disposal.

The LCA method is now officially regulated in the ISO standard series UNI EN ISO 14040 and UNI EN ISO 14044 of 2006.[17] It is a tool assessing consequences for the environment by a product or an activity over its whole life cycle; therefore it is aimed at preserving human and environmental health, as well as saving resources. In compliance with ISO 14040 standards, the LCA procedure is technically organised into four separate and sequential phases, namely:

1. **Goal and Scope Definition**: This is the preliminary phase defining the aims of the study, the functional unit, the boundaries of the studied system, the requirements and reliability of data, the assumptions and limits.
2. **Life Cycle Inventory (LCI):** This phase is focused entirely on the study of the life cycle of a process or activity; it is aimed at reconstructing and making a quantitative assessment of processes through which the flow of energy and of materials supports the functioning of the production system under evaluation, by the means of all transformation and transportation processes.
3. **Life Cycle Impact Assessment (LCIA):** It studies the environmental impact caused by the process or activity and aims at reporting the degree of changes (impact categories) ensuing from releases into the environment and consumption of resources calculated in the inventory.
4. **Life Cycle Interpretation and Improvement:** This is the final phase of a LCA, aiming at suggesting the necessary changes in order to reduce the environmental impact of processes and activities under study, by means of repetitive assessment tools to facilitate a decision-making process, if necessary to achieve environmental sustainability and efficiency.

In addition to clarifying the main goals of the study, one of the main steps of the Goal and Scope Definition phase is to define a functional unit, i.e. the product, service or function on which the analysis will be based, as well as for comparison with other possible alternatives. The functional unit defines the reference object in our study, to which all input and output data shall be referred to, and which shall be consistent with the LCA goals and its scope of application. The main objective of the functional unit is to provide a reference to which the inputs and

[16] Society of Environmental Toxicology and Chemistry - SETAC (1993) - Guidelines for Life-Cycle Assessment: a code of practice. SETAC, Brussels, 1993.

[17] ISO 14040:2006 Environmental management - Life cycle assessment - Principles and framework. ISO 14044:2006 Environmental management - Life cycle assessment - Requirements and guidelines

outputs can be related (ISO 14040). The product quantity that is necessary to meet the function requirements is called reference flow, from which input and output flows to the system can be calculated. A comparison between different systems is only possible if the same quantified functions are analysed by using the same functional units and reference flows. During the Goal and Scope Definition phase, the physical boundaries of the system also need to be defined, i.e. which processes and aspects are considered in accordance with the goals of the LCA study.

The second phase (Life Cycle Inventory - LCI) involves creating a model of reality offering the most precise inventory of all exchanges (from the raw materials supply to produce an object, to its management during the "end-of-life" stage) between single operations and processes belonging to the system under study (Baldo et al., 2005). Three steps characterise the LCI: data collection, calculation and interpretation of results. Data collection implies a detailed explanation of supply methods (direct, indirect, and elaborate) and of categories to which data belong (material, energy, environmental releases). Direct or primary data include data directly measured on the field through analysis and/or monitoring, or data directly obtained from involved production activities/companies, whereas data deriving from existing literature sources or data banks are to be considered as indirect or secondary data. The calculation method processes input data by comparing them with the chosen functional unit. This phase also includes the processing of any missing data with the relevant motivation of their absence. The calculation method produces the following results: solid, liquid and gaseous emissions, quantities of finished and/or semi-finished products, and energy consumption. The LCI results must be carefully analysed in order to verify the quality of data and the final data related to mass and energy. The correctness and suitability of methodological choices made in the calculation procedure are also assessed. The LCI results are the starting point for the next step, i.e. the Life Cycle Impact Assessment (LCIA).

The ISO 14040 standard identifies three mandatory steps in the LCIA: (i) selection and definition of impact categories, providing completeness, independent judgement and practicality; (ii) assignment of LCI results (classification) by assigning the inventory data to the different impact categories; (iii) modelling category indicators (characterisation) by means of models able to convert the LCI results assigned to the impact categories into specific common units of measure (e.g. equivalent CO_2). A few optional elements are also suggested, among which the normalisation of data, i.e. the comparison with a reference value allowing to report the different results obtained for each impact category into a normalised (reference) value; the grouping of results (i.e. based on a hierarchical system according to the order of priority, or on a nominal basis according to release characteristics); the weighting of indicator results across impact categories through numerical factors in order to create a single final indicator assessing the environmental damage; the data quality analysis assessing their meaning, calculating the uncertainty and sensitivity of the LCIA results. The first operation to implement in the LCIA phase is, namely, the selection of the environmental consequences (or impact categories) on which the

analysis will be based. This choice depends on the type of method of impact analysis (Eco-indicator, CML[18], EPD[19], etc.)

The fourth and last phase (Life Cycle Interpretation) consists in identifying the significant factors in the life cycle analysis and evaluating the final results obtained. The outcome of the interpretation phase is also a set of conclusions consistent with the goals of the study and included in the defined scope of application, with the production of a final report suggesting potential solutions to be implemented in order to reduce the environmental impact of the system or product under study.

3.6.2 LCA training sub-module (content, organisational and didactical measures)

Against this background the LCA training sub-module of GREEN STAR has been structured into four subsequent levels of learning (following the main structure of GT VET), as follows:

- LEVEL 1 is aimed at supplying basic information on LCA key concepts such as "life cycle", "emissions/releases/consumption of resources" and "environmental impacts".
- LEVEL 2 aims at going in-depth and understanding the logic behind the LCA, i.e. how materials and energy that we use can have effects/impacts as described through adequate environmental indicators, which are the final result of the LCA.
- LEVEL 3 shows a detailed understanding of the LCA methodology in all its phases, and it includes a practice exercise. The Level 3 is targeted to students/apprentices and workers with a prior knowledge of basic concepts on environmental impacts, production processes, waste management.
- LEVEL 4 not only provides a further in-depth analysis of the LCA methodology, but it also suggests strategies to use and spread the results of a LCA study, with a special focus on green /green marketing labelling. The Level 4 is targeted to workers with an in-depth knowledge of product and manufacturing processes.

The four levels of learning will have a different time development and they are organised in such a way that they can be adapted to different needs. In-depth study activities are developed on the basis of the learners' degree of basic knowledge.

The following table contains detailed information about each level of in-depth learning. These training levels are then summarised in the charts 1 to 4, with a list of the activities to be implemented by the tutor/trainer, their goals and strategies

[18] CML is an environmental Impact assessment method created by the University of Leiden in the Netherlands in 2001.

[19] An EPD® (Environmental Product Declaration) is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products

developed to favour content learning, e.g. presentations, practice exercises etc. The duration and the necessary didactic materials are also specified in the charts. Suggestions and examples for a better understanding of the type of in-depth analysis and the learning materials and methods sorted by level are then included in the website www.greenskills-project.eu.

	L.1 – Basic Information	L.2 – understand background and coherences	L.3 – professional practical knowledge	L.4 – process know how
Title of the training unit	The life cycle concept of a product	The concept of environmental impact, effects and indicators	The methodology of LCA	LCA and green marketing
Learning outcome	To use the "life cycle" concept of a product (cradle-to-grave) To be able to distinguish the different phases; for each phase, to identify interactions with the surrounding environment	To analyse the concept of environmental impacts and their difference with respect to an environmental effect, as well as understanding the meaning of environmental indicators	To understand the methodology of the life cycle assessment, see how it is structured according to the ISO 14040-43:2006 standards, and what type of results are obtained	To understand the meaning of the life cycle assessment, see how it is structured according to the ISO 14040-43:2006 standards, and conduct a LCA study.
Background information required	No specific knowledge	Minimum / basic knowledge	Basic concepts on environmental impacts, production processes, waste management	In-depth, work-based knowledge
Approximate duration	90 minutes	120 minutes	8 hours	8 hours
Target group profile	First-level trainees / apprentices	Technical schools students - Workers	Workers	Specialist/ responsible in the company
Learning process	Presentation and group work	Presentation and group work	Presentation and group work, practical task	Presentation, group and project work

Level	Content	Methodology
L.1	Discover that each product has its own history starting before its supply and continuing after the end of use, and this history can be improved once there is knowledge about the impacts associated with the product. To learn the concept of “life cycle” of a product (cradle-to-grave), i.e. to be able to distinguish the different phases (from raw materials extraction and supply to product processing, manufacture, use and disposal); for each phase, to identify interactions with the surrounding environment, by using concepts such as “environmental releases” and “resource inputs” (resource: what is purchased from the surrounding world? emissions: what is released into the environment? waste: what is generated?). To understand that key concepts such as “resources” and “releases” are the basis for the definition of “impacts” on environment and human health.	See chart below
L.2	What is the meaning of the environmental impact of a product starting from its raw materials and going through production, transport and use, until its disposal? How is environmental impact measured? How are environmental performances evaluated? This level shows what lies behind the LCA without following the LCA methodology according to the ISO standards.	See chart below
L.3	Practical implementation of LCA? What is under analysis with a LCA? What is it for? What is a LCA study like? The trainee will understand in detail concepts such as “functional unit”, “system boundaries”, “material and energy flows”, “inventory”, “allocation” and “impact quantification”	See chart below
L.4	In addition to understanding the concepts learned in level 3, level 4 is aimed at learning how LCA can be conducted and how the results can be used and disseminated for “green marketing” purposes.	See chart below

Level 1 -The concept of "life cycle" of a product (cradle-to-grave)

Tutor/trainer	Objective	Method	Duration	Methodology notes
Welcome address	Stimulating curiosity	Short presentation	5 min	
Introduction to the theme: concepts of life cycle, resources and releases	Activating and motivating this theme by starting with a product or an example	Presentation + guided discussion by the tutor on a product	15 min	The chosen final product / example must be easily "divided" into its primary components
Detailed explanation of the life cycle of a few products of interest in a sector, association of releases and resources to the impacts	Checking knowledge about familiar products and associating resources / releases / impacts	Presentation + conversation	30 min	Selected products based on the reference sector (e.g. wood furniture items: window; refrigeration: fridge, etc.)
Exercise aimed at distinguishing the life cycle phases and the interaction (exchange) with the surrounding environment	Collecting information, understanding and elaborating	Practical exercise	30 min	The practical exercise includes matrixes and associations to be made
Contents summarised and final discussion	Listening	Guided discussion	10 min	

Level 2 -The concept of environmental impacts, effects and indicators

Tutor/trainer	Objective	Method	Duration	Methodology notes
Welcome address	Stimulating curiosity	Short presentation	5 min	
Presenting the concepts of life cycle and exchanges with the environment (releases and resources)	Understanding the connection between life cycle phases and exchanges of materials and energy	Presentation	10 min	
Presenting the concepts of “effect” – “impact” – “indicator”	Awakening curiosity: “How is impact measured?“	Presentation + conversation	30 min	
Exercise aimed at “calculating and quantifying” the impacts	Collecting information, understanding and elaborating	Practice + group work	30 min	This practical session includes using Excel sheets and measures to calculate the impacts (practical exercise)
Which indicators?	Stimulating attention to several indicators : “Why can more than one indicator be used?”	Presentation + conversation	30 min	The focus is not on the formula or on the mathematical model to calculate the indicator, but on the reason why several indicators are needed to evaluate the environmental performance
Contents summarised and final discussion	Listening	Guided discussion	15 min	

Level 3 - The meaning of the life cycle assessment

Tutor/trainer	Objective	Method	Duration	Methodology notes
Welcome address	Stimulating curiosity	Short Presentation	5 min	
Presenting the concepts of life cycle, exchanges with the environment and impacts	Understanding the connection with the concept of life and the impacts	Presentation	15 min	
Presenting the LCA methodology	Identifying the specific phases of the LCA methodology	Presentation + conversation	240 – 360 min	To be split in 2 or 3 meetings depending on the needs
Exercise aimed at an in-depth study of the following concepts: functional unit, system boundaries, inventory, allocation problems	Collecting information on all processes involved in the life cycle of each component of a selected product and of its packaging. Understanding and processing inventory data	Practice, group work	120 - 240 min	LCA study to be conducted with the suitable software in the demo version (e.g. SimaPro), on a specific product of interest
Contents summarised and final discussion	Listening	Guided discussion	15 min	

Level 4 – LCA and green marketing

Tutor/trainer	Objective	Method	Duration	Methodology notes
Welcome address	Stimulating curiosity	Short .ppt presentation	5 min	
Presenting the LCA methodology	Identifying the specific phases of the LCA methodology	.ppt presentation + conversation	240 – 360 min	To be split in 2 or 3 meetings depending on the needs
Exercise aimed at an in-depth study of the following concepts: functional unit, system boundaries, inventory, allocation problems	Collecting information on all processes involved in the life cycle of each component of a selected product and of its packaging. Understanding and processing inventory data	Practice, group work	120 - 240 min	LCA study to be conducted with the suitable software in the demo version (e.g. SimaPro), on a specific product of interest
LCA and green marketing	How are the results of the LCA used?	.ppt presentation + conversation	60 – 120 min	Environmental Product Declaration, Carbon Footprint, Ecological Footprint, Water Footprint
Contents summarised and final discussion	Listening	Guided discussion	15 min	

Table 8 Sub-module LCA - Overview, Content and Didactical Measures

References

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4

GREEN STAR Approach and Modules

It has been said that experience is the best teacher. With that and the blueprint of GT VET in mind, the following chapter encompasses the core reflections and activities supported by GREEN STAR stakeholders.

The first part is dedicated to the summary of the literature review which identify and explores the four conceptual pillars of the green skills' introduction within the value chain of automotive suppliers: automotive, clusters, sustainability and skills. The four keywords embrace different factors intervening into a collective learning process: technology issues, policies, environment and human resources.

The second part considers the regional backgrounds related to automotive suppliers of the three participating regions: North Western Romania, Basque Country and Veneto. With regard to the latter, it is depicted a comprehensive overview of the framework regulations for districts and innovation networks management as well as the principles and the rules underpinning the apprenticeship system (relevant and being the background for the VET system implementation, see chapter 4.5).

The third part presents the general framework, participative approach and methodology underneath the transfer of GT VET and the definition of the actions undertaken, including the evaluation design to assess the impact of each activity.

The fourth part fully displays three case studies, described as "Action Plans", to test the Sustainable Module for Green Skills in the involved partner companies. An experience in the field of continuous training, involving a selected sample of SMEs aimed at validating the module in additional sectors (namely, home appliances). The training submodules considered are: Energy, Waste and Life Cycle Assessment.

The fifth part goes down to the rest of the learning chain, by showcasing the application of the sub-modules in higher technical education, secondary technical education and the apprenticeship system.

The sixth and last part highlights the main results obtained by the impact evaluation carried out by an external evaluator through interviews, questionnaires and data collection.

4.1 Literature Review: Automotive, Clusters, Sustainability and Skills

Giovanni Bernardi

This chapter does not represent a classic literature review, as it is not a complete analysis, therefore it does not provide a thematic comparison between papers and authors, because the topics of the in-depth analysis, research themes, the reference framework and the training modules have been defined by *practice issues* of the companies following the results of the focus groups´ meetings of the project.

Nevertheless, it represents an analysis structure, starting from the matrix represented below, in order to provide a common framework, further developed with additional suggestions from various partners. This is done with summary sheets outlining the content of some very wide reports (with up to 400 pages, sometimes probably useful only for the specific aims of the project), helping to select rather fragmented literature references.

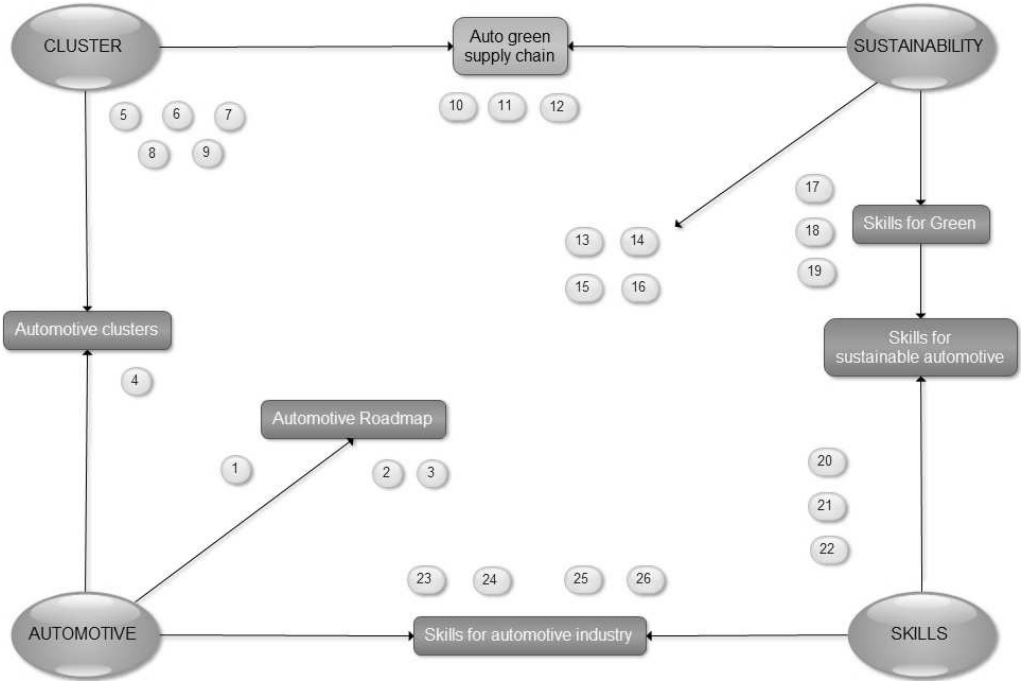
Therefore, this review (done as one of the first steps of GREEN STAR) provided a starting point for reflection and discussion, a sort of thematic memorandum for further project activities.

Papers have been searched by typing in the following keywords: **Automotive**, **Skills/Competence**, **Sustainability/Green**, **and Cluster**. Therefore two databases have been used mainly: Scopus and Scholar. Naturally, using single keywords means getting about 2-3 million search results. In order to manage this data in a useful way, it has been necessary to combine more keywords, for example with three keywords a selection of about ten titles is obtained (on Scopus). However, by combining more keywords a lack of results was produced which led to the choice to select articles related at least two combined keywords.

Moreover, the academic traits of the scientific literature in Scopus need to be taken into consideration.

Better results have been obtained by going through reports related to European projects or to institutional research studies (e.g. public institutions, trade associations, etc.). Priority had been given to official documents (EU papers, OECD publications etc.) and easily available literature on the Internet.

Basically, a selection has been made, about 270 titles have been analysed. Out of this the main 26 references (listed at the end of the chapter and in the following mentioned in brackets [reference]) they have been mapped with a theme-based position to the main issues as shown in the figure below. The position of the different papers is only a guide for readers. In fact, some paper is crossing different themes and can have several attributes which generate diverse placing in the map.



(The numbers 1-26 are representing the references at the end of the chapter.)

Figure 9 Map of the literature according to the four main issues of GREEN STAR (automotive, cluster, sustainability, skills)

Automotive

Literature on the single topic "automotive" obviously concerns technical evolution both from design and planning related aspects, e.g. electric cars or industrial economy in general: production, employment, industrial policies, and evolution of industry structure.

Within the GREEN STAR perspective, the selection focused basically on research studies centred on the Technological Road Mapping (TRM) methodology, largely in cooperation with IFM Cambridge. This methodology allows understanding of developing trends within a sector connecting markets, technologies, systems and resources, also people and their skills, depending on the perspective of each specific research project. [1,2,3]

The emerging trends, starting from technologies related to the development of sustainability, concern the product being used, rather than the process to produce it. Processes are nonetheless considered, particularly in connection with new materials and energy issues, and they are important to define and connect skills.

The two key dimensions of impact are **pollution** as a general issue and within the product Life Cycle Management, and **energy** consumption related to production as well as to the means of transport. Although the different Technological Road Mapping (TRM) strategies originate from different national contexts (Australia, UK, USA), technological trends have an impact on the afore mentioned issues, namely within an evolving perspective focusing on new

materials, electricity storage, materials handling systems, recycling, air and water emissions, and more widely speaking on all typical green topics.

Report [1] considers the following technological priority areas, having a direct impact on product sustainability:

- Engine and powertrain (E&PT)
- Hybrid, electric and alternatively fuelled vehicles (HEV)
- Advanced software, sensors, electronics and telematics (ASSET)
- Advanced structures and materials (FASMAT)
- Design and manufacturing processes (DMaP).

The main priority applications currently influencing the cluster are (and will also have influence in the future):

- Vehicle Electrification
- Gaseous Fuels
- Lightweight
- Data and Communications.

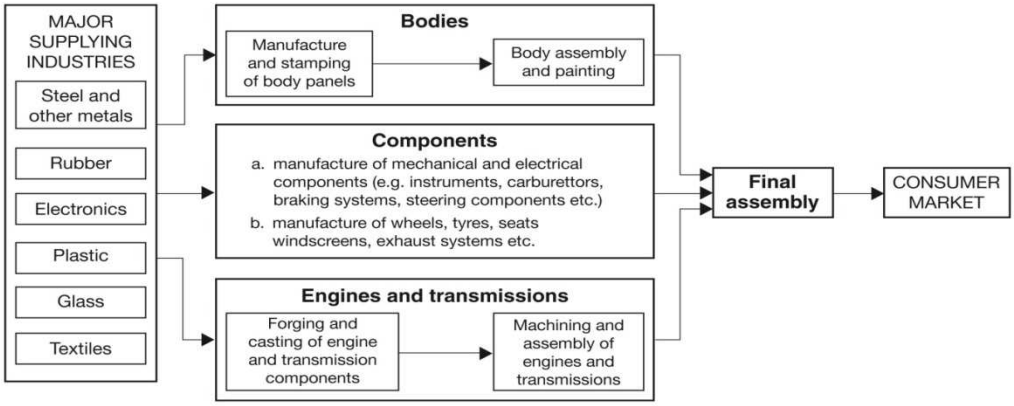
As can be clearly observed, these two perspectives converge toward a possible integration.

By analysing the road maps (TRM) green awareness is not a particularly emerging issue, unless related to legislation, to policy restrictions imposed by authorities or stakeholders, or to the demand for "greener" products resulting from customers' increasing awareness (although such a trend is growing, demand-pulled products are limited to market niches).

Furthermore, a central issue in the analysed research studies is the structural change within the sector, leading to a new outlook with a decentralised assembly of subsystems, therefore to relationships with suppliers/tiers of different levels, up to suppliers of commodities or raw materials. This issue is linked to one the following topic (clusters, chapter 4.1.4) which represents the consequent perspective in the near future.

Although offshoring is showing signs of going against the tide (e.g. back shoring in the USA favoured due to the tendency to create clusters), it is still predominant and affecting the modular planning of products and the development of joint platforms within an approach still based on mass production. At any rate, the supply chains are still quite long, within an industry where the suppliers provide the 70%-80% of the final value.

This tendency has been coupled, in connection to the increasing product complexity, with the shift of engineering skills towards the suppliers, thus taking the final shape shown in the graph below, which is basically the same in almost all supply chains of the final dominating companies (OEM).(Dicken, 2003)



Source: Dicken (2003a)

Figure 10 The basic automobile production chain

The large prevalence of this model leads to two consequences:

- On the one hand, sustainability becomes a matter related to the supply chain and the green topic being inextricably associated with the green supply chain. To this effect, downstream industrial customers can stimulate increased sustainability upstream, also according to approval procedures such as ISO 14000, having regulatory functions as was the case with ISO 9000 quality standards in the dissemination of the Total Quality Management (TQM) concept.
- On the other hand, suppliers are increasingly becoming the suppliers of competence embedded in the supplied part and in its design, contrary to being mere suppliers of production capacity. Thus, the value proposal and, by reflex, the engineering ability achieve greater importance and, furthermore, design for environment (DFE) skills shall also belong to the suppliers' competences, e.g. to SMEs.

The GREEN STAR proposal, principally suggesting top suppliers or tiers rather than to final assemblers and OEMs, appears to be resting on solid ground.

This approach mingles well with the transition from an industry-based logic to a cluster-based one; the transition along the chain moves away from the focus on the OEM's final product and towards an increased focus on tier-specific technological solutions.

This probably explains the lack of specific literature on green skills for clusters, as these systems bring together several different technological streams, whereas the industry-driven logic was characterised by homogenous technological solutions.

Sustainability

This topic has already been well developed in the previous GT VET research (cross-reference) and is also valuable for the GREEN STAR Project, except for specific elements related to the steel industry. Within this literature review

sustainability is considered in connection with the automotive sector [13,14,15,16].

As far as sustainability is concerned, the above depicted automotive system ranging from OEMs to other suppliers (see figure 10) shares common problematic issues and the relevant basic skills required: pollution, energy saving, new energy sources, etc., although they must be related to various and different contexts.

Specifically speaking, production processes see the gradual shift from individual mechanical processing operations or other basic technologies to simple or complex assembly tasks; this obviously differentiates environmental implications of the different companies along the production chain.

In general, even the most accurate studies on Technological Road Mapping (TRM) suggest that the pathway to sustainability passes through all the other issues, without specific emphasis. The structure based on a cluster-integrated supply chain leads to an association of the green issue to the whole chain with any result obtained inevitably related to each and every production phase. To this extent, the boost of green skills deriving from requirements set in the technical specifications of a component or processing, originating from final OEMs to upstream suppliers appears to be of fundamental importance, which is as it was for TQM in regulatory terms..

As chapter 2.2 presented a key interpretation of the green topics in the automotive sector, namely the LCA model (elaborated further in chapter 3.6 and 4.4.3) and the relation to the supply chain the following table from Nunes summarises the most popular green practices applied in the automotive industry.

Green operations practices	Activities of the operations functions	Objectives
Green building	Production capacity planning	Enhance environmental performance during construction and operation of an industrial plant considering sustainability of the production site, water and energy efficiency, resource and materials use, indoor environmental quality, and innovation and design process
Eco-design or design for environment	Product and process development	Consider the product's life-cycle in order to design more environmentally friendly products and use environmentally sound processes
Green supply chain	Supplier relationship and in-bound and out-bound logistics	Incorporate environmental criteria and concerns into organisational purchasing decisions and long-term relationship with suppliers
Green manufacturing	Manufacturing (production)	Incorporate environmental criteria and concerns into organisational purchasing decisions and long-term relationship with suppliers
Reverse logistics	Supplier relationship, logistics and after sales	Plan, implement and control backward flows during process and after use of finished goods, mainly to end-of-life products
Innovation	All activities and beyond operations including business model designs	Improve goods and services and increase profitability

Excerpt from Nunes, B., & Bennett, D. (2010). Pages: 401-402

Table 9 The most popular green practices applied in the automotive industry

The document [15] is an important institutional paper for possible links when looking from a cross-sector point of view. In a different approach to be considered it is highlighted how to re-use the competences developed by the human resources that have been working in automotive sectors and converting them into green jobs.

Chapter 2.2 mentioned the relationship between green and automotive through the green supply chain model. This topic is also developed by authors of papers within the review [10, 11,12]. The authors assume that it is not possible to become "individually" green: The automotive industry, featured by a high rate of suppliers, can cope with the green challenge by involving the whole supply chain and the sub-supply chains, also to adopt and implement the related regulations and standards (i.e. ISO 14000).

Skills

More than one million search results are obtained in databases for this single keyword, proving that this issue has been and is currently a topic of study and practical implementation, at company level both regionally and sometimes nationally (also in terms of individual competence certification). However, a narrower search combining the term 'skills' with other keywords reduces the pool of results dramatically. This gives evidence of a "historic" field of research which, however, on its own is a mere starting point.

The availability of suggestions and clues for analysis concerning more specific skills for green however is much more restrained. References can be found in the wide institutional index on the broader issue "New skills for new green jobs" (see also GT VET project, CEDEFOP and ILO reports [17, 18]). These are basic and general reports based on 21 country studies.

The document „Skills for green jobs – European Synthesis Report" (CEDEFOP, 2010) is related to a well-known classic report, part of the EU OECD institutional literature review on green issues, edited by CEDEFOP (2009) "Future skill needs for the green economy" that quote [18] as for reference. This report has been already quoted in the previous GT VET project. It is a more general paper, complete reading without reference to the automotive industry. Particularly interesting is the distinction between "Greening existing occupations" and "New green-collar occupations" (see also the green occupation and skills definition in chapter 2.2).

A previously submitted research [14] suggests the identification of skills for green automotive on various hierarchical levels, according to the following scheme:

	Example Qualifications	Example job roles
Level 1	Skills for Life basic literacy and numeracy	[few job roles in the automotive sector are at level 1]
Level 2	Apprenticeships – at operator and semi-skilled level Business improvement techniques Lean	Mechanical Maintenance Fitter; Metal working and machine operatives; Quality control (batch work); Manufacturing Process Operator; Maintenance Operator; Materials Handler
Level 3	Advanced Apprenticeships – at craft and technician level	Toolmaker; Composite technician; Electrical maintenance technician; technical support engineer; Electrical design engineer; motorsport technician; Engineering project manager
Level 4, 5 & 6	Higher Apprenticeships Bachelors' Degree HNDs / HNCs Foundation Degrees	Manufacturing Senior Technician; Senior Controls Technician (Mechanical Testing); Senior Electronics Production Technician; Automotive Senior Technician

Excerpt from [14], 2013 - Source: Semta Apprenticeship frameworks relevant to careers in automotive

Table 10 Qualifications and job roles by level (related to the UK NQF)

Human resources are often identified in literature as critical. However, this criticality mostly concerns future occupational trends rather than the critical green skills needed. A UK case analyses technical skills shortages and how to motivate and attract young people to enter the automotive sector, which does not seem to be attractive for them.

In paper [21], by the NSDC[20]of India, the need for new skills to green the automotive sector is pointed out. This research paper is probably the closest to our aims for its highlights on mapping the competences needs. The paper states that "Human resources" are one of the critical aspects and also underlines trends on the competence needs which could be related to every type of VET area, in broad terms . These trends include increased electronic, content complicated engine designs, plastics emerging as a replacement to metals and hybrid vehicles.

In other words, the paper examines the position that human resources have in terms of functions related to the supply chain position. A hierarchical level analysis shows that OEM and tier 1 functions demand "skills required" and "skills gap" on different hierarchical levels. On one hand, it's very specific for what concerns "car manufacturers", on the other hand it's less important since it describes: Two-wheel, industrial vehicles, dealers, etc.

[20] The National Skill Development Corporation (NSDC) is a Public Private Partnership (PPP) in India set up to facilitate the development of skills

The paper describes a map analysis for each level. For example, the following analysis regarding an operator/ workman:

Function	Level	Skills required	Skill gaps
	Operator/ Workman	– Should have basic literacy, analytical ability and the ability to understand and follow shop floor instructions – Should have relevant knowledge of working of car systems, such as working of a fuel circuit, functioning of the cooling circuit, etc. – Ability to operate and or maintain both general and special machines such as wheel nut tightening machine, fuel and coolant filling machines, flexible manufacturing systems	– Tendency to consider only the current activity (say tightening a bolt) being performed, no understanding of where the activity fits into the big picture – Inadequate trade knowledge and poor application of the available trade knowledge – this can be attributed to the fact that institutions such as ITIs do not teach such skills specific to the Automotive Industry

Excerpt from [14], 2013

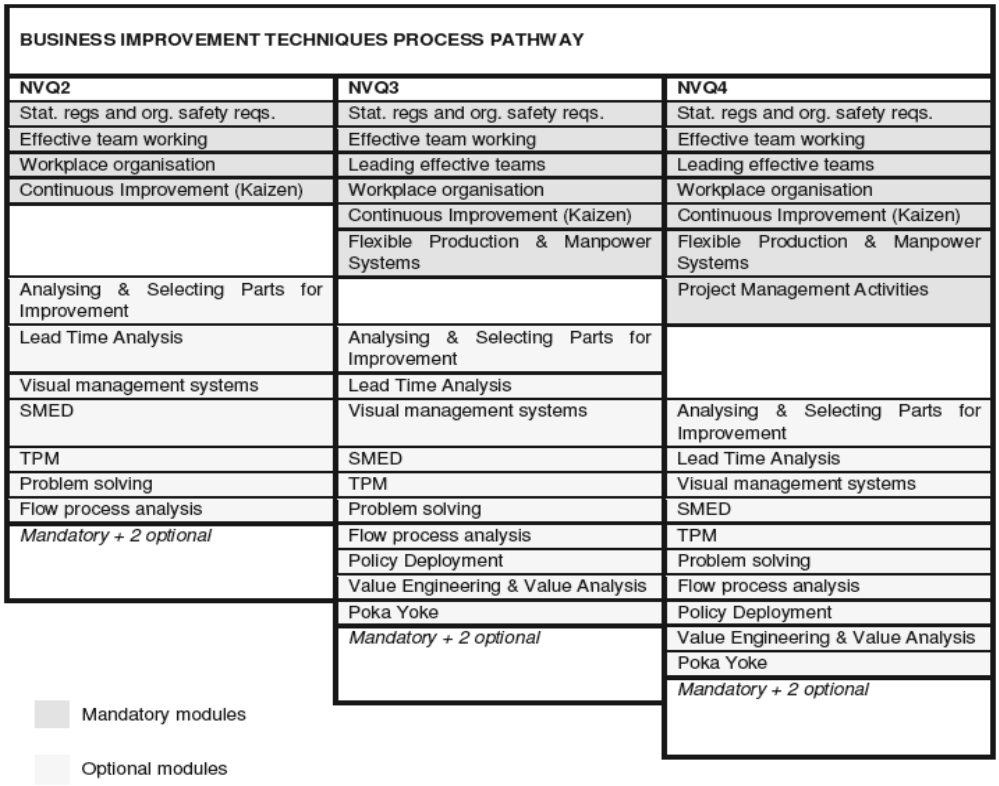
Table 11 Skill requirements and skill gaps common to auto OEMs and large tier 1 suppliers

Another recommended research, a study on skills for automotive, has been conducted by Bevis [20].[21] This article is one of the most related ones to the GREEN STAR point of view, as it is succinct and easily read, even though it is less oriented to the sustainability theme. It introduces the UK's National Vocational Qualification (NVQ) system for levels 2, 3 and 4 by suggesting the following steps:

1. Determine the level of provision of skills development amongst both the private and public providers and the drivers for that provision.
2. Determine declared skills development needs for SMEs.
3. Help guide national policy on skills development for the Automotive Industry's SME community.
4. Propose a training model that supports sustainable development for SMEs in addition to quoting again the characteristics of NVQ levels, to make them readily available for everybody.

[21] The paper had different revisions. For our aims only the first draft will be considered.

A full array of elemental modules of the National Vocational Qualification (NVQ) programme entitled "Business Improvement Techniques" is set out in the figure below.



BUSINESS IMPROVEMENT TECHNIQUES PROCESS PATHWAY		
NVQ2	**NVQ3**	**NVQ4**
Stat. regs and org. safety reqs.	Stat. regs and org. safety reqs.	Stat. regs and org. safety reqs.
Effective team working	Effective team working	Effective team working
Workplace organisation	Leading effective teams	Leading effective teams
Continuous Improvement (Kaizen)	Workplace organisation	Workplace organisation
	Continuous Improvement (Kaizen)	Continuous Improvement (Kaizen)
	Flexible Production & Manpower Systems	Flexible Production & Manpower Systems
Analysing & Selecting Parts for Improvement		Project Management Activities
Lead Time Analysis	Analysing & Selecting Parts for Improvement	
Visual management systems	Lead Time Analysis	
SMED	Visual management systems	Analysing & Selecting Parts for Improvement
TPM	SMED	Lead Time Analysis
Problem solving	TPM	Visual management systems
Flow process analysis	Problem solving	SMED
Mandatory + 2 optional	Flow process analysis	TPM
	Policy Deployment	Problem solving
	Value Engineering & Value Analysis	Flow process analysis
	Poka Yoke	Policy Deployment
	Mandatory + 2 optional	Value Engineering & Value Analysis
		Poka Yoke
		Mandatory + 2 optional

Mandatory modules

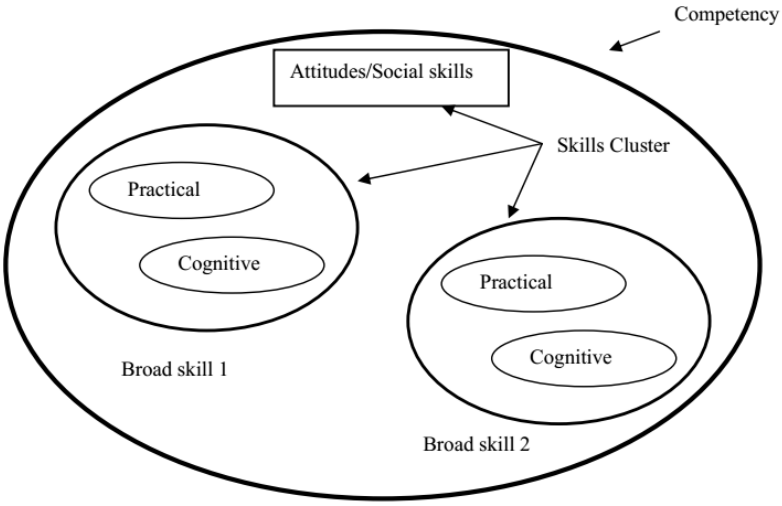
Optional modules

Excerpt from Bevis, 2008, p.12

Table 12 Business improvement techniques process pathway

This article clearly describes the NVQ level features. Both GT VET and GREEN STAR refer also to four levels, very similar to the British system and to the well-known Leich report.

Report [21] is an example of how to produce a competence based curriculum within the auto technology. The final example is related to the undergraduate level and could be of relevance for green skills development as well (as summarised in the following figure and table).



Excerpt from Weerayute Sudsomboon, 2007

Figure 11 Concept of Competency

Knowledge and understanding	Skills	Attitudes
1. Knowledge of basic engineering and fundamental of automotive mechanics 2. Knowledge of chosen field of automotive technology concepts. 3. Good understanding to automotive technology concepts. 4. Good understanding to explore the document, fix manual, advanced tools for inspection and guideline to solve problems. 5. Good understanding to applied engineering practice 6. Appreciate relevance to other fields 7. Knowledge requires students to engage in complex thinking and reasoning processes as they complete long-term, meaningful tasks.	1. Ability to apply the knowledge. 2. Ability to communication skills, both oral and written in Thai, English and universal language. 3. Ability to brain-based education 4. Possess problem solving skills 5. Skills on critical thinking, creative thinking and self-regulated thinking (System thinking) 6. Adaptability 7. Have safety management ability 8. Possess technical skills	1. Ethics, moral and care full Thai culture. 2. Professionalism role. 3. Desire for life-long learning. 4. Openness to new ideas. 5. Positive attitudes. 6. Involved with community. 7. Conscious in energy conservative and save environmental. 8. Have discipline itself.

Excerpt from [21] Sudsomboon, W. (2007). pp. 3 -7

Table 13 Competencies framework of automotive technology subjects on attributes competencies

Clusters

High attention has been given to the cluster topic, also as single keyword, by devoting six reports on this issue [4,5,6,7,8,9]. This increased focus of attention finds its explanation in the change of perspective compared to the previous GT VET project based on one sector, and also because the relevant literature is recent and of a different nature. Moreover, overlapping and ambiguity remain, not only from a semantic point of view, but also related to its practical meaning, with respect to traditional industrial aggregations in a territory, e.g. industrial districts in Italy, and network-based structures in general.

Porter's (1998) definition of clusters as "geographically proximate groups of interconnected companies and associated institutions in a particular field, linked by commonalities and complementarities" had a strong influence and were subsequently further developed by his colleague C. Ketels (2003), inspiring the

"Green book on clusters" in its various editions [8]. Several books followed: the Bluebook in 2006, the Redbook in 2009, the Orange book in 2013 (analysing Swedish Clusters). Finally, the same authors published the Green book 2.0.[22]

The books propose several examples from a number of countries and focus the clusters' objectives, their nature and their competitiveness potential. It clearly brings to light that the scope of objectives and activities of cluster initiatives largely differs. Rather than focus only on cluster's concept, the authors explore its activities, mostly similar to technological transfer services, district or sector training, Academies, infrastructures and logistic services.

Within such approach, the cluster is considered as an evolution of districts, providing high value services to its members. The approach became widespread and the OECD adopted it as a formal definition. (Möhring , 2006)

"Clustering" refers to local concentrations of horizontally or vertically linked firms that specialise in related lines of business together with supporting organisations, though definitions as to what exactly constitutes a cluster vary greatly. There is a distinction between a cluster that is predominantly vertical, representing stages along a supply chain, and one that is predominantly horizontal, consisting primarily of rivals and competitors.

In the initial studies dating back to the 1990s, clusters resembled districts very much, and many traditional districts (such as eyewear in Belluno, Italy) were quoted as examples of clusters. The focus of attention was on the competitive dimension, as clusters were seen as a competitive factor in order to boost competitiveness at company level and within a region, also by involving the relevant territorial authorities. This had a strong impact on the literature and on the clustering projects of other countries such as those in Eastern Europe, so clusters have gradually become the result of government policies aimed at supporting the economic development of a territory which in turn supports firms and institutions. Cluster is a new construct for local economic development.

The literature agrees [8] that the members of a cluster share four critical characteristics:

- *Proximity*: They need to be sufficiently close in space to allow any positive spill-overs and the sharing of common resources to occur.
- *Linkages:* Their activities need to share a common goal, for example, final market demand, to be able to profit from proximity and interaction.
- *Interactions*: Being close and working on related issues is not enough – for positive cluster effects to occur some level of active interaction has to be present.
- *Critical mass*: Finally, there need to be a sufficient number of participants present for the interactions to have a meaningful impact on companies' performance.

Understanding the importance of these four dimensions is much more relevant than defining specific benchmarks that a group of firms and institutions has to meet to be called a cluster.

Other authors referred to clusters within the non-declared logic of the Triple Helix: [5] "Cluster […] offers new roles for business, government, institutions;

[22] Publications can be downloaded from the website mentioned in reference [8].

and new ways for institutional relationships both in advanced and developing economies". This latter perspective seems to be the most suitable one, e.g. the development of clusters in an area where no leading firms have taken root yet, but where the local government has an interest in developing strong funding policies.

The formal structure of clusters seems to meet the requirement of finding a business model for SMEs, and this seems to better reflect our point of view in GREEN STAR. SMEs were initially encouraged to become suppliers of production capacity at the time of the decentralisation of production. In the period of mass production they went through delocalisation and were then significantly reduced in capacity by the competition of low-cost countries. Joining aggregations allow them to go up again in the value chain, e.g. by means of production systems such as MTO and ETO [23], and is one of the few opportunities not only to preserve but also to develop their store of competence.

Another alternative, which can be associated with the development of broader territorial clusters, is the diversification according to product similar sectors, with competence-based strategies not bound to the industrial sector. By way of example, let us think of companies specialised in surface coating, special welding processes or micromechanics, ranging from eyewear (a declining sector for sub-tier suppliers) to low-cost jewellery and electro medical devices, e.g. still thriving sectors with good prospects for technological development and internationalisation.

The ability to "gather strengths" however, has not been easy and obvious within a local entrepreneurial context; therefore it must be stimulated, strengthened and probably supported by central public and private stakeholders. This necessarily and positively leads to the need for a "control room" or the development of agencies devoted to reaching this target, and of consistent regional industrial plans strongly supported in the medium term, rather than with occasional piecemeal interventions.

As already mentioned at the beginning, the development of clusters in the automotive sector [4] is also connected with the transformation of this sector in the structure, layout and location of its supply chains, especially with the development of new competitive trends towards shared top suppliers (sub-assemblers, tier 1).

Thus, "clusters - regional concentrations of specialised companies and institutions linked through multiple linkages and spill-overs - provide an environment conducive to innovation. They enable 'open innovation', the creation and refinement of new ideas in networks of cooperating companies and institutions. And they lower the barriers for transforming new ideas into businesses." (Enright, 1999)

Ideas about clusters, their nature, roles and contents are still diversified [6]. The same applies to the differences between clusters and districts, and clusters and industries [6].

[23] MTO (Make to Order) is a manufacturing process in which manufacturing starts only after a customer's order is received. Starting with development designing is ETO (Engineer To Order).

It can be useful in order to clarify the meanings of different types of connections to start from the classic models of territorial innovation. "What distinguishes clusters from these other models has not been clearly defined and continues as a source of confusion among scholars and practitioners. Indeed, these concepts - clusters, industrial districts, innovative milieu, and technology districts - are often used almost interchangeably despite having origins in different conceptual contexts.

Like clusters, other "territorial innovation models" are regional agglomerations of firms that provide localised institutional dynamics that enhances innovation and growth in the region. Because there is a lack of conceptual clarity […] they defined a cluster as a group of business enterprises and non-business organisations whose membership within the group is an important element of each member firm's individual competitiveness." John/Pouder, 2006 [6].

Porter's main point on what differentiates clusters from historical intellectual antecedents and more recent theories of agglomeration is that clusters comprise a multi-organisational form that play a key role in *competition* and have a strong influence on market economies.

Therefore, different types of clusters could be generated. Jacobs and de Man (1996), noting the broad general concept of a cluster, reviewed the research literature and highlighted six dimensions that underlie the structure and activity of geographic clusters of firms:

1. *Horizontal:* several direct competitors in the same or closely related industries
2. *Vertical:* firms in adjacent phases of the supply chain
3. *Lateral:* firms in different industries that share or draw from common capabilities or resources
4. *Technological:* firms in a collection of industries that share a basic technology
5. *Focal:* firms are drawn to a central entity such as a dominant firm, research centre, or educational institution
6. *Network quality:* degree and processes of inter-firm cooperation.

The distinction between "technology cluster and industry cluster" (Breschi and Malerba, 2005) will be further considered mapping it on the supply chain, identifying the related boarder in terms of knowledge/competencies.

Moreover, "[…] clusters grow in regions that provide specific advantages as a location for companies' activities in a particular field. They can enable linkages; clusters reach their full economic potential if clusters are well connected to markets and clusters elsewhere and cluster participants cooperate to strengthen linkages and align decisions. And government can mobilize efforts within regions and clusters to increase joint action." (Europa Intercluster, 2010).

Again, with regard to development policies, article [5] shows some practices. The paper concerns clusters development policies and it also describes pragmatic examples by case studies; it summarises the results of European partnership projects, VINNOVA and The competitiveness Institute TCI. The most interesting part is the first one, related to the role and the reason for being clusters. It's also

interesting to consider the analysis on public policies functions described throughout clusters.

The quoted example [13] from the West Midlands (UK) points out the importance of clusters for regional development, and for new employment policies, whereas the example from Slovenia is rather based on new territorial development in order to attract investments.

An interesting distinction (Europa InterCluster, cit., 2010) is suggested between “area cluster” and “power cluster”. “Some clusters, “area clusters”, tend to be geographic entities, eco-systems, pools of competencies where, in a particular area, productive interactions arise between the different components of the triple helix: universities, research, and business. Such "area clusters" will increasingly turn into the regional anchor points in the globalised world, and may even acquire a relocation dynamics of their own. The others tend to be real "virtual companies", with a full value chain, provided that their management teams have equipped themselves with a capacity for strategic monitoring, enabling them to act as true integrators and facilitate the emerging of business clusters, mostly made up of SMEs, which together will act as European spearheads on world markets. These "power clusters" will be Europe's commercial launching pads for the rest of the world. For some […] a cluster is a matter of observation […]. For others, a cluster is a matter of action […] with the goal of promoting innovation. This may be referred to as a power cluster.” (Europa InterCluster, cit., 2010)

Anyway, what seems to characterise significant clusters is the fact that they combine research, innovation and business for the emergence of "collaborative knowledge". When companies form clusters to exchange knowledge, e.g. on non-competitive themes, on basic VET skills and on sustainability, everything runs smoothly as long as processes are not involved. There are no problems, either, when these processes are regulated; on non-competitive themes, on basic VET skills or on sustainability, everything runs smoothly as long as processes are not involved. There are no problems, either, when these processes are regulated; the most likely outcome will be the competitiveness to achieve a green label first. In terms of innovation, this process is most likely to become essential, being a marketing lever rather than a price indicator. As an example, a focus can be bought to the Eco-Management and Audit Scheme (EMAS) award attracting foreign tourists in Italian hotels.

In the context of collaborative clusters, the customer-supplier relationship changes into a “demand-driven learning chain” characterised as follows:

a) Closer direct interactions between assemblers and suppliers
b) Creating demand-driven learning chains. Suppliers cite many factors to explain why they have recently started requiring better educated workers and introducing more in-firm training, workers’ skill development: their interest in improving quality, and demand from customers
c) The third mechanism of supplier upgrading, inter-firm spill-overs of embodied knowledge and skills, may take various forms. Former employees of vehicle manufacturers become independent suppliers, assemblers and suppliers share employees, and workers formerly trained at assemblers move to supplier firm” (Okada, 2004).

Despite the various classifications used it is our opinion that, rather than following a replacement approach with clusters concerning Italian or Marshallian industrial districts, a developmental approach could be taken into consideration. This will be done with clusters become the evolution of districts in the medium-long term, without creating them all over again on a fertile breeding ground, but with pre-existing widespread competencies and localisation benefits.

In other words, two approaches concerning the development of technological districts can be identified: the first approach concerns the presence of an oligopoly, or almost a dominant monopoly (e.g. eyewear, sports system). This transition often goes hand in hand with the shift from a family enterprise to a structured corporate one, but also by resorting to external funding. This can easily lead to statements reducing districts to the classification of family businesses with low technology and labelling clusters as groups of bigger enterprises distinguished by higher technology. The second approach proposes a wider perspective, often with more integrated business models linked to longer production and supply chains because of internationalisation (e.g. long or delocalised chains), therefore causing the distancing from the district (e.g. as found in Fiat).

An additional approach is related to supporting and integrating the district development with common services, shared resources, research centres, aiming towards an institutionalisation of the district itself in the eyes of public institutions defining strategic policies and funding policies above all, in close connection with employment policy perspectives and/or territorial transformations (e.g. West Midlands, Slovenia, etc.).

This would lead to say that clusters are either a new system or district, or a kind of localised network being institutionalised. The logical and factual perspective is the implementation of the Triple Helix Model, by intersecting public and private systems even formally with the setting up of new agencies.

The strive for building definitions brings overlapping, analytical and even peculiar conclusions. Thus Hamdouch (2008) defines clusters by considering the development of network types, notwithstanding the ambiguity and broad-spectrum characteristic of the term itself, eventually identifying eleven different types!

Nevertheless, issues concerning cluster planning and creation arouse more interest than definitions themselves, especially the advantage of this model compared to the traditional industrial one, particularly when trying to identify the needs of skills for green. Let's try to clearly distinguish the two models:

Cluster:	Industry
Localisation	Trans-regional, long chains
Focused on cooperation	Also global
Long-term collaborations	OEM-focused
Common services	Sector with network related to final product technologies
Overlapped supplier-customer competencies	Need for standard-competence-encoding, interface modularity
Shared supply chains	Also in standard components to get economies of scale through outsourcing
Institutional knowledge sharing	
Economies of scope	
Triple helix	
Development, support and funding policies	

Adapted from [6], St. John, Pouder, 2006

Table 14 Distinction between Cluster and Industry

Unlike other articles, [9] could be considered a user's guide, a toolbox, for setting up and managing a cluster. This thus highlights the foundation and constructivist dimension of clusters against the district philosophy based on gradual budding.

4.2 Regional Background and Cluster Descriptions (Veneto, North-Western Romania, Basque Country)

In the following chapters the three involved regions Veneto, Cluj and Basque Country will be described as a background, a cluster for the green skills development and improvement. The regional and cluster related collaboration is very important in laying the ground for efficient (e.g. not every SME has to developed and train green skills) and effective (e.g. better quality by combining resources and having a common skills development strategy) training on the transversal green skills.

4.2.1 The Automotive Parts Industry in the North-Western Region of Romania

Elisabeta Dumitrescu

Analysis of the automotive parts and subassemblies manufacturing sector has revealed that, in North-Western (NW) Romania, there is a relatively small number of companies (125 companies) operating in the field.

Partly, these are former state-owned companies that have adapted to the new economic conditions as they had undergone the privatization process during 1990-2000. Whereas their production was initially represented by a wide range of components, for various applications, currently they are almost exclusively

focused on supplying parts for the automotive industry. Although they are holders of the know-how and have secured themselves a place on the map of world producers, the domestic companies are still using equipment of the 1980-90s; that is why they are focused on the procurement of modern equipment and provision of qualified workforce. They are aware that withstanding the market means primarily improvement of issues relating to quality and competitiveness; therefore the companies started to invest heavily in this area by upgrading and providing advanced training for the workforce. New SMEs have been established in this sector, which unlike the former state enterprises, benefit from the most modern equipment as they adjust far more easily to the new requirements.

Through investments designed for increasing productivity and competitiveness, the green issues related to production have also been favoured indirectly, both on the technological and workforce level. They invest in new, less polluting technology, with lower energy consumption and provide training for the staff operating the new equipment, often conducted by the equipment producers themselves.

There are a lot of challenges the Transylvanian producers have to face, but the most critical ones are the lack of an adequate training system to provide skilled human capital and the lack of associations to represent and promote their interests. Unfortunately in Romania, a number of factors such as deindustrialization, liquidation of large industrial platforms, massive numbers of staff layoffs, employment of few young workers and calling off state-enterprise education contracts, have caused the decline of vocational education. For a short time vocational education has even been cancelled in favor of the theoretical education, the effect nowadays being a shortage of qualified staff.

In 2011, the Education Law reconsidered vocational education, by enabling partnerships with private companies within the dual system school/company. Under this program schools may conclude partnerships with companies that would become the students' future employers, this co-operation being particularly based on practice. Setting up and developing a strong vocational education system, tailored to the economic needs and the labor market demands, is now a priority in Romania. Specialised state bodies are entrusted to carry out an open dialogue with the employers' representatives with a view to creating the most appropriate national training system. For example, in March 2014, the management of the Kronstadt German Vocational School and a group of German companies in the country's central region (Daimler AG, AHK, Schaeffler Romania, Star Transmission, Marquardt Schaltsysteme SCS, DWS Sibiu, DWCTimisoara, Christiani, Draexlmaier and Continental) addressed the National Centre for Vocational and Technical Education Development with proposals regarding vocational education. One of the proposals referred to the organisation of the vocational education in the dual system.

In the context created by the European Union, a generator of low carbon emissions, for a policy of enhancing green economy, it is essential to improve development of specific professional skills in the auto parts manufacturing industry. This process is a long one, but it is absolutely necessary in order to ensure adaptation of Romanian companies to the future market conditions that provide regulations and use of environmentally low impact technologies.

Currently, the institutions where a constant concern is apparent about energy efficiency and greening technical skills at all levels, are the universities and some other organisations that provide courses on green issues (e.g. ClujCCI is successfully delivering the course for European Energy Managers for all those interested in applying energy efficiency measures within enterprises, buildings, transports and public lighting among others). Green skills are included into the university curriculum and are providing the students with the ability of incorporating sustainability at all organisation levels. Future accountants may attend courses for calculating the company's carbon footprint, those from marketing get knowledge for green marketing so that an enterprise statements claiming sustainability may be proven whereas future managers learn how to incorporate sustainability into the company strategy. Considering that a wide part of the active labour force is formed of skilled workers, the need for continuing training through skills acquisition has become obvious, in order to enable adaptation and success of domestic companies under the circumstances of globalisation.

Another issue that influences the activity of auto parts manufacturers in the NW region of Romania is the lack of cohesion among members of the same sector. Developments recorded in the field in recent years and competition from foreign companies has made Romanian producers aware of the benefits granted through a close cooperation, the use of a common platform with competitors and extending the networking portfolio by including technology and telecommunications companies.

In 1996, the Automotive Manufacturers Association of Romania (ACAROM) was established nationally, bringing together 142 members, who were different sized companies dealing with design, manufacturing and the trading of cars, materials, components, modules, car parts or performing services related to auto and auto equipment manufacturing and maintenance.

The Western Region was the first area of the country where the companies producing automotive industry parts came together to form the Regional AUTOMOTIVEST cluster. It was aimed at creating an economic environment in the support of an automotive "cluster" initiative, through developing a central service platform for the regional companies (suppliers/customers) active in this field.

Considering the sector dynamics and the current premises, we may consider that establishing a cluster association in the NW part of the country is only a matter of time, in which actors of the auto parts industry can better account for their interests in relation to competitors, customers and state bodies.

4.2.2 The Basque Cluster Policy: The Automotive Cluster ACICAE

Joseba Sainz de Baranda

Cluster policy

Since the 1990s, implementation of cluster policies has helped to strengthen the Basque industrial fabric, a highly useful analytical tool when it comes to

providing cohesion to the complexity of production activities and facilitating their relationship with the territory.

The progressive evolution of the model has given rise to the 22 business groups that make up the Basque cluster and pre-cluster fabric, promoted by the Internationalisation Section of the Basque Government Department of Economic Development and Competitiveness (DDEC), and currently coordinated by the Basque Business Development Agency SPRI. This is done with a team of more than fifteen people, responsible for facilitating and maintaining open communication in monitoring their action plans.

New Management Approach

Immersed in a process of improvement since their founding, the evolution of the Basque clusters has, over time, seen their management directed towards the gradual development of the pyramid of cooperation in implementing their action plans on their strategic areas of operation. Its goal is to promote cooperation among its members, when addressing the strategic challenges for each cluster, with a marked focus on making SMEs stronger.

It is a tool that creates value for its environment, as a result of public-private cooperation, aligned with its performance in deployment of strategic institutional policies: Industrialisation Plan, Internationalisation Plan, Science, Technology and Innovation Plan, and RIS3 – Smart Specialisation, among others.

Action Framework

Cooperation actions arise from the matrix resulting from the logic of the Strategic Cluster Plan and the Strategic Action Areas defined in the Basque Government economic and competitiveness strategy, including internationalisation, technological and business innovation

Internationalisation takes place by:

- Companies accessing new global markets and niches and their integration into global value chains
- Implementation of collaboration initiatives and projects in inter-cluster opportunity areas such as offshore, smart cities, etc., in order to gain access to new global markets and niches
- Support for attracting activities and establishment of foreign companies, as well as strategic industrial projects that contribute towards completing the value chains of each cluster.

Technological Innovation encompasses:

- Increase the technological and innovative content of cluster company products
- Apply converging technologies in developing inter-cluster collaboration initiatives and projects
- Facilitate RVCTI (Basque Science, Technology and Innovation Network) collaboration with cluster companies in joint development and technology transfer projects
- Increase environmental and energy sustainability by increasing efficiency and saving resources in the cluster value chain

- Integrate advanced manufacturing processes in production transformation links
- Incorporate new enabling technologies: EICT, BIO, NANO, sustainable energy and green economy into the production process and finished products.

Business Innovation is focused on:

- Support the creation of Complete Activity Chains, from R&D to market
- Encourage and support entrepreneurial initiatives in cluster companies
- Dimensioning and convergence of companies
- Facilitate people participation in companies
- Develop new business models and access new inter-cluster opportunity areas by combining existing capabilities and converging technologies
- Develop new specialised financial tools
- Align cluster actions with the smart specialisation strategy
- Actions linked to Advanced Manufacturing in the field of non-technological innovation, including the implementation of EICT tools for companies.

Background – Automotive industry

The Basque automotive industry is one of the most competitive and innovative in the world, its origin in long tradition of industry, finance and trade dating back to the 19th century which still prevails. Its management levels are very advanced, with a high degree of effectiveness and efficiency.

Basque automotive sector at a glance:

- Main industrial sector in the Basque Country
- **17% of the GDP** of the Basque Country
- 300 Companies - 230 production units outside Spain.
- 13 billion turnover, representing 40% of the Spanish components industry
- Direct employment of 76,000 people in 28 countries
- **Export of 90%** of its production

It is made up of 300 companies with a turnover of more than 13 billion euros and employs more than 76,000 people, of which 35,000 are in the Basque Country. To this we must add the specific weight of Daimler Vitoria, where it manufactures its commercial vehicles, Vito and Viano, in addition to the assembly-line production of the electric Vito.

This sector currently has 558 production plants in the world, of which more than 230 are outside Spain, mostly in emerging markets like Eastern Europe, Brazil, Mexico and China.

This international presence makes it possible to accompany vehicle manufacturers and first-tier suppliers in their globalisation process, offering the highest guarantees of rigour, becoming strategic allies in the early stages of large global projects.

Moreover, the Basque Country has more than 30 multinational companies in the sector, with major competence centres that bring value to the industry and its parent organisations.

The new AIC-Automotive Intelligence Center stands out as a unique value-generation centre that is working for the whole industry to cooperate in areas such as knowledge, training, technology and industrial development.

The integrity of the industry comes from having the whole value chain in a very small environment, ranging from steel makers, manufacturers of capital goods and machine-tools, die makers and machinists to universities, research centres, consultants, engineering firms, among others.

The creation of the automotive component industry cluster (ACICAE) originated from the need to modernise the sector and improve the competitiveness of a firmly established industrial activity in the Basque Country. This is in the form of small and medium-sized enterprises, whose evolution depends directly on the evolution of the car industry. Nowadays, ACICAE is located at the AIC and in 2014 had more than 160 partners.

Objectives of the ACICAE Cluster

ACICAE is a business group, formed with the aim of improving the level of competitiveness of automotive suppliers by means of joint business activities at a national and international level looking for business opportunities with manufacturers and suppliers and promoting relationships between Basque companies, as well as between science and technology companies and the Basque science and technology network. It also collaborates with the Basque Government in the implementation of policies that may affect companies in the sector.

The main objectives of ACICAE are:

- To improve the strategic vision of the automotive industry
- To promote cooperation between partner companies on various matters
- To promote training and the adoption of new advanced management models
- To increase the level of research and development plus innovation (R&D+i) in the sector and in companies
- To attract local, national and European projects bringing value to the sector.

Strategic lines

With the aim of improving the competitiveness of the supplier companies integrated into the automotive cluster, inter-cluster cooperation is encouraged. To this end, its strategic plan sets out the following strategic lines:

- Increasing the added value of products through intensification in the innovation of products and processes, as well as their most complex development through collaboration with customers in the field of R&D+i
- Growth in the size of the companies involved in the value chain, as well as the development of international competence centres, attracting activities with high added value

- Promoting the internationalisation of business activities that will make it possible to increase the presence of the Basque components industry in international markets. In this sense, we are looking to establish international partnerships and connect with the key centres in the sector worldwide
- Increasing the flexibility of companies, this reduces response times at all levels and enables optimum coordination between all of the agents involved at the different levels of the value chain for a rapid adaptation to change.

Actions

The clusters general actions are aimed at improving the level of quality in management, technological innovation, internationalisation and the promotion of inter-company collaboration.

The work areas on which ACICAE is focusing its activity fall on four strategic areas:

- The **strategic area of knowledge management** focuses on training professionals, their relationship with the companies in which they operate and how they manage them. In addition, this area includes advanced management systems as a source of competitive advantage that is transferred to all of the company's main processes.
- The **strategic area of internationalisation** urges support for the international presence of companies by encouraging interaction and cooperation between companies in the cluster in search of entry into new markets, as well as consolidating the existing ones, both from the point of view of customers and geographic areas.
- The **strategic area of technology** favours promoting technological innovation. This area has a permanent forum for participation open to all companies in the cluster. One of the specific projects that have been coordinated through this group is the technological map, which dictates the guidelines to be followed in the field of technology by sectoral working groups or technological progress groups (shock absorbers, brakes, etc.).
- The **strategic area of monitoring** focuses on providing strategic information to companies in the sector. It supports the other strategic areas by defining their objectives, as well as assessing the opportunities and the feasibility of projects.

In addition, the **Automotive Intelligence Center (AIC)**, which opened in 2009, translates the vision for the sector into reality. It was founded by the Provincial Council of Bizkaia, the Town Council of Amorebieta-Etxano, the Town Council of Ermua, ACICAE-Automotive Cluster of the Basque Country, ZF Lemförder TVA, Pierburg, CIE Automotive, Amaya Telleria and Microdeco. AIC is a centre which generates value for the automotive sector based on coordinating highly qualified individuals with a clear market orientation. It is based on the principles of integrating knowledge, technology, industrialisation and the development of new business.

The objectives of AIC are:

- To generate and attract innovative projects
- To undertake scientific research activities and technological development
- To promote training in the automotive sector at all professional levels
- To promote the endogenous creation of new business projects of high added value in the sector
- To attract innovative projects.

Among the projects in which the AIC is involved, there are R&D+i units, training centres and industrial development units. In total, more than 27 organisations and 650 professionals are working in these facilities.

4.2.3 The Industrial Districts of Veneto

Simonetta Mantovani, Giorgio Cester, Paolo Armellin

In Italy, small and medium enterprises (SMEs) employ more than 80% of the workforce and provide 75% of the Gross Domestic Product (GDP). These data underline the importance of SMEs and craft companies in Italy. In order to find a suitable tool for strengthening their role in domestic and international markets and to overcome the severe economic situation, EU first and then Italy have developed **ad hoc legislative instruments**. The Veneto Region supports companies in establishing structured partnerships. The **Industrial districts** in Veneto (regulated by the Regional Laws on production clusters No. 8 of 4 April 2003 and No. 5 of 16 March 2006) are a primary form of aggregation/ network among companies established as local production systems in a specific territory. The industrial district in Veneto has become the expression of the ability of company systems and local institutions to set up a strategic plan for the development of the territory, in accordance with regional legislation and programmes. The industrial (and handicraft) districts in Veneto, set up after the 2nd World War and developed in the whole region until the 1970s in a uniform and independent way, make products appreciated on the international markets for their innovative features and quality and they represent a significant share of Veneto's export.

The constantly changing economic and production environment requires the implementation of new tools able to cope with the scenarios presented by global competition, in order to support and boost the presence of Veneto companies on the global market. As a consequence of the economic situation in recent years, it was therefore necessary to make innovative decisions. In order to stem the crisis and, at the same time, to boost the economy, the Veneto Region reviewed its regulation on industrial districts that were showing unsustainable constraints (the projects were only focused on specific needs rather than on a strategic and broad horizon, and characterised by too much bureaucracy to comply with). The debate between the Veneto regional government and the economic, social and academic actors of the territory led to the implementation of a new regulation - **the Regional Law on Industrial Districts, Regional Innovative Networks and Company Networks/Partnerships (R.L. No. 13/2014)** – which established **new and more flexible ways of aggregation for companies**

aimed at working on strategic projects. These characteristics boost the competitiveness of companies and their ability to build winning developments models.

Industrial Districts, Innovative Networks and Company Partnerships

The production districts regulated by the previous regional legislation were recognized on the basis of the submission of a three-year development pact, signed by at least 100 companies (joining the district on a voluntary basis). The production districts did not have boundary (territorial) delimitation, thus all the Veneto companies of the production chain could be part of them. In 2006 there were **46 industrial districts/clusters**, many of them operating in the provision of services. The new regional regulation (R. Law No. 13/2014) is focused on the production areas with a particular emphasis on the tradition and history of typical products that are connected to specific territories. The regional policy can thus concentrate on a smaller number of production systems (17) which are the manufacturing excellence of Veneto on the global markets. The new law establishes new forms of aggregation, different from the concept of the traditional district (i.e. the company networks, involved in multi-sectoral business, are not strictly connected to a specific territory but have relations at national and international level). The networks are mainly involved in research and innovation activities, thanks to several partnerships/collaborations with universities and other research institutes, both public and private ones. The Veneto region is then characterised by small and very small companies that need to overcome their size-related vulnerabilities by developing and sharing common projects and results - The Company Networks/Partnerships are thus made up of a few small companies working in the same production chain/sector and deciding to face common problems together.

The Regional Law No. 13/2014 defines three categories:

1. Industrial District
2. Company Network/Partnership
3. Regional Innovative Network.

While industrial districts and company networks are identified by the Veneto regional government on the basis of a consolidated recognition, the Regional Innovative Networks are established on the basis of strategic projects proposed by the network itself. Considering the functional specificity of the above mentioned categories, some financing tools have been set up and tailored to different needs, in order to achieve better results and efficient use of funds for making Veneto more competitive at international level.

- Industrial District

There are 17 Industrial Districts in Veneto. The new Law No. 13/2014 defines an **industrial district** as a production system, located within an area in Veneto, characterised by a high concentration of craft and industrial manufacturing companies, who are mainly small and medium enterprises (SMEs) of specific production chains/strategic sectors for the economy of the Veneto region. A

production system can be defined as an industrial district when it has the following characteristics:

- concentration of craft and industrial manufacturing companies;
- located in a specific area/territory
- characterised by tradition and history of typical products connected to specific territories
- competitiveness in the area of innovation and internationalisation.

- Company Network/Partnership

To overcome their size-related vulnerabilities, companies can develop a common strategic project by joining in different types of aggregation ranging from the network contract to the consortium and the business associations, even temporary ones. The Company Network/Partnership is, therefore, a set of companies that "come together", even occasionally, to propose more targeted and specific projects in order to solve common problems and to share the challenges of innovation. The following elements characterise the Company Network/Partnership:

- at least 3 companies that come together to implement a specific project
- the companies could belong to any production sector (not necessarily from the same sector)
- suitable type of aggregation: network contracts, consortia, cooperative companies, or temporary business associations.

Within the company network/partnership, companies work together towards a common outcome, while maintaining their autonomy as individual firms. The SME networks/partnerships are able to recover the competitiveness of the Veneto products on the global markets, by strengthening the regional production excellence and supporting the exchange of knowledge and skills. This is done by streamlining costs, making it possible to achieve a critical mass which is useful for the development of innovations. The structure of the company network/partnership is very flexible and light, as well as temporary (the time necessary for the implementation and completion of the project).

- Regional Innovative Network

The development of the economic systems has led to the establishment of new types of company networks that are not related to a specific territory. The regional innovative network is an aggregation of companies and public and private actors committed in implementing innovative actions to different production sectors. These actors are able to develop a set of initiatives and projects relevant to the regional economy.

The following elements are characteristic of a Regional Innovative Network:

- A network spread across the territory (even beyond regional and national borders)
- New or innovative entrepreneurship
- New or innovative sectors.

The regional innovative network becomes a more flexible supply chain, often a transnational one, allowing the single industrial sector to move towards multi-

sectoral models in order to meet demand more effectively. The network is related to a market need with a shared vision among the actors to provide access to niche markets or emerging industries of strategic importance for regional economic development. It is, therefore, a strategic tool to support the Research and Innovation Strategy for Smart Specialisation of the Veneto Region, the main strategy for regional development in 2014-2020. Through this tool, the Veneto Region aims at developing regional innovation systems to be able to support and enhance the production areas of excellence. The Veneto Region has identified four areas to focus on: **Agrifood, Smart Manufacturing, Sustainable Living and Creativity**. In this context, the establishment of regional innovative networks plays a key role in the adoption of policies for the economic development of the Region.

Labour policies to sustain the Veneto production system

Over the years, the Veneto region has shown special attention towards the implementation of a set of targeted and synergy-based interventions, in order to develop human resources in the management of change and innovation for the competitive development of the Veneto districts.

Pilot actions have been tested leading to stronger competitiveness of the Veneto region's social, economic and employment system, by means of implementing methodologies focused on the enhancement of human resources and on the innovation of currently available competence models. This strategy made it possible to sustain the permanent upgrading of the production system to restructuring and innovation processes, while maintaining constant attention on the territory, on the system of companies and on the single employee. This was done by enhancing mutual integration and exchange associated with the synchronous development of these three factors.

Working for the development of human capital in the Veneto production districts offers a wider reflection on the significance of measures implemented by the region to sustain employment, competitiveness and productivity of the Veneto system.

- Regional planning (POR-FSE)

The Veneto region has developed a Single Regional Planning Scheme deeply characterised by the growth of enterprises considered as the cornerstone of the socioeconomic system in order to preserve jobs and create new ones. This planning activity will constantly be characterised by the involvement of social partners from whom an increasingly more qualified contribution will be required.

The issue at stake concerns employment not only from a quantitative point of view, but also from a qualitative one. The development of skills and higher professionalisation can be achieved only within an effective system of initial training, as well as of learning and permanent upgrading of professional skills in order to enhance and constantly adapt the human capital to change.

The following challenging goals shall characterise the new planning development since its initial stage:

a) Prevent and reduce long-term unemployment

b) Support permanence at work and the re-employment of workers affected by redundancy
c) Increase youth employment
d) Promote the participation of women in the labour market, also by means of supporting demand for care services
e) Increase employability and participation in the labour market for disadvantaged people and segments at risk of social exclusion.

Efforts are intended to be concentrated on a few types of recipients: enterprises, entrepreneurs and employees (men, women, young people, older workers), in order to provide useful resources and tools for increasing the number of jobs and maintaining existing ones.

- Youth guarantee schemes

The European Council's recommendation of 22nd April 2013 states that "Member States should develop and implement Youth Guarantee schemes whereby every young person under the age of 25 years receives an offer of employment, continued education, an apprenticeship or a traineeship within four months of leaving formal education or becoming unemployed".

With Regional Decree No. 551/2014, the Veneto region approved the Regional plan for the implementation of Youth Guarantee schemes for young people between 15 and 29 years of age. They did this with the dual aim of supplying considerable resources to tackle the employment emergency, and of laying the foundations for the establishment of a permanent youth guarantee scheme.

Regional measures are structured according to the top priority-based involvement of enterprises that must invest in the youth, in order to integrate new talents and new knowledge within the production context, thus energising the human capital which is the real driving force of enterprise competitiveness.

- Job placement measures: The apprenticeship system in Veneto

In Italy, apprenticeship programmes have taken on a central role in the employment policies and, within the training framework, they represent not only a promotional tool for youth employment, but also a strategy to integrate school, work and training systems.

Regulated for the first time by Law No. 25/1955 and then defined by the "Treu" Law No. 196/1997 as a primary tool to promote youth employment, the National Legislative Decree No. 167/2011 ("*Consolidated Apprenticeship Act*") defined apprenticeships as "a permanent contract aiming at the training and employment of young people".

The apprenticeship contract should be the main way for young people (18 - 29 years old) to be employed in the labour market. Its core objectives are:

- To provide young people with qualifications facilitating their access to the labour market and increasing mobility
- To avoid professional skills shortages, tackle skills mismatch and foster lifelong learning
- To reduce the incidence of unemployment
- To promote faster and more efficient school-to-work transitions

- To support economic growth, competitiveness and productivity.

The Veneto Region approved the Regional Law No. 21/2012 for the implementation of the "*Consolidated Apprenticeship Act*". Since the apprenticeship contract is the main way for young people to be employed in the labour market, the Veneto Region adopted a bottom-up approach by involving the social partners in sharing the regional legal framework for the implementation of the provisions, as stated in the "*Consolidated Apprenticeship Act*".

The word 'apprenticeship' might indicate a variety of different concepts and different on-the-job learning models across Europe. The European Commission identifies three main types of work-based learning models:

1. Alternance schemes, based on the model of the German dual system
2. On-the-job training periods in companies within the framework of VET schools
3. Work-based learning integrated in school-based programmes, such as simulations or specific assignments.

In some EU member countries, an apprenticeship is a form of job contract with specific characteristics taking into consideration the learning aspect of the working experience. Regions contribute to such schemes with measures, funding, and the coordination of different actors.

Italian schemes of work-based learning

1) Within school programmes (alternance scheme from 15 to 19 years of age) and University programmes (from 19 to 25 years of age, academic education – degree, PhD etc.). Moreover, an apprenticeship might be based on job contract schemes including formal training (it being necessary to obtain a Vocational Qualification or Diploma).
2) A Traineeship which is not related to education programmes:
   - finalised to long-term employment: 6 months
   - post-lauream: max. 2 years
3) It applies to the first job experience (15-29 year-olds): apprenticeship includes formal and on-the-job training (2-5 years)

Apprenticeship schemes

Apprenticeship to obtain a formal education qualification:

- Vocational Qualification or Diploma
- Higher Education and Research
- Vocational apprenticeship to obtain a labour market qualification, recognised by companies.

Vocational apprenticeship to obtain a labour market qualification	Apprenticeship for an educational qualification	Higher education and research
Young people between 18 and 29 years of age (or 17 in case of a 3-year vocational qualification) Duration: 3 years. Low skilled or high skilled profiles could decrease the duration to 2 years. For craftsmen it is up to 5 years. The job contract is regulated by a complex system reflecting multiple interests of: – central government and national social security agencies; – collective agreements with social partners – regional government agreements with local social partners	3-year vocational qualification and diploma Young people aged between 15 and 25, who obtained at least the certificate from Junior Secondary School (3 years) Duration: 3 years for vocational qualification plus 1 year for diploma 22 national vocational training profiles (e.g. construction worker, chef, plumber) Regional programme duration: 440 hrs. per year (320 hrs. basic skills; 120 hrs. vocational skills)	Young people between 18 and 29 years of age Duration depending on the type of educational programme (2 years for post-graduate master degree, up to 4 years for doctoral college and 5 years for adult education programmes) The programme must be jointly defined by academic institutions, regional authorities and social partners (mainly employers) Training programmes are usually focused on skills needs of medium/large enterprises or spin-offs Regional funding is dedicated to post-graduate masters

Table 15 Apprenticeship Schemes (Italy)

Vocational apprenticeship in the Veneto Region requires the following sequence of actions:

1. Definition of rules for apprentices (protection) and enterprises (duties)
2. The Region MUST define and agree on the rules with the local social partners
3. Training centres which are directly sponsored by social partners: selection and macro-sector aggregation
4. Design training modules and then include them in a catalogue
5. ICT platform-based management system
6. A monitoring system

In the apprenticeship contract, training programmes are compulsory to account for state aid. There are two types of compulsory training:

A. Vocational training (to acquire technical vocational skills) is provided by the company hosting the apprentice, according to the national collective labour agreements, which define its duration and implementation. Training activities are carried out under the responsibility of the company, which also bears the costs. A tutor (an expert worker of the company) supports the apprentices.

B. Basic cross-sector training is designed by the Veneto Region, according to the available funds, with the aim of providing basic skills. Basic training is provided by vocational training organizations (accredited by the Veneto Region).

Basic and cross-sector training

Recommendations of the European Parliament and of the Council of 18th December 2006 on key competences for lifelong learning (2006/962/EC) are:

5 out of 8 key competences are included in the Veneto Region catalogue and provide the basis for 13 learning modules in the industry sector				
Communication in foreign languages	Digital competence	Learning to learn	Social / civic competences	Sense of initiative / entrepreneurship
English basic skills	Basic module	Basic module	Basic module	Basic module
English intermediate skills	Medium module	Medium module	Medium module	Medium module
Italian for foreigners				
German basic skills				
French basic skills				

Each training module lasts 40 hours and it must be completed within one year, starting from the date of employment. The Green Star Action plan for Apprentices, described under chapter 4.5, was designed within the framework of the basic and cross sector training for vocational apprenticeship to obtain a labour market qualification. The Green Star module content was tested within the Module "Social and civic competences – advanced".

4.3 General Framework: Cluster Approach and Methodology

Gabriella Bettiol, Chiara Salatin

In the following chapters two dimensions will be described in detail: The approach to the module transfer, adaptation and development and the evaluation design to understand the impact of the Action Plans and ensure the quality of the project processes and results.

It is worthy to be noted, the first dimension involved all those stakeholders, including the partners, concerned, committed and capable to influence and improve the cooperation within the learning chain (school - apprenticeship – higher technical education – continuous training – company) to foster green skills acquisition and application to production processes.

The evaluation design, based on the Theory of Change (TOC) methodology described in chapter 4.3.2 was proposed by an external evaluator and then applied to each Action Plan.

4.3.1 The Development of the Training Module: A Participative Approach to Work-based Learning

The challenge

The transfer of the GT VET blueprint and the adaption of training modules required three types of transfer processes:

- From industry (steel) to cluster (automotive);
- From large to small and medium sized enterprises;
- Application to three different types of vocational education and training settings: work-based, apprenticeship, higher technical education (non-tertiary).

The partnership was built in order to mirror the stakeholders' ability to support the process; the competence and know-how of other relevant stakeholders were integrated through dedicated international Focus Groups, a conference at the Basque Automotive Intelligence Centre and meetings in Italy, Germany, Romania and Spain. Beneath these meetings, the process was grounded in a literature-based analysis (see chapter 4.1).

Focus Groups

In Dortmund the Technische Universitaet organised the first Focus Group involving the partnership and external stakeholders who took part in or monitored the GT VET initiative, such as ThyssenKruppSteel, the German Federal Institute for Vocational Education and Training BIBB, UNESCO UNEVOC, the European Steel Technology Platform ESTEP. Additionally, a higher technical education institute "ITS Meccatronico" and the vocational training company "Forema" from Italy participated as well.

Below the implemented scheme of the adaptation process content, methodology and the cluster approach were integrated, in order to fit and anticipate skills requirements.

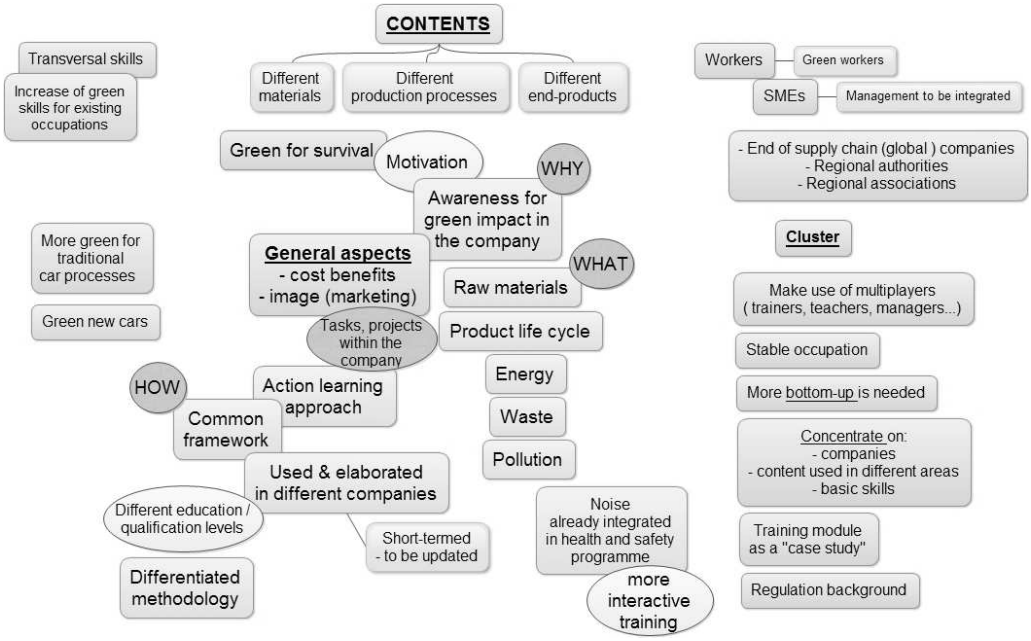


Figure 12 The development of the GREEN STAR training module

The partnership, according to the literature analysis and the hands on experiences of the companies involved, defined at least three modules to be adapted:

- Energy
- Waste
- Product life cycle – Life Cycle Assessment (LCA).

Following to a second Focus group in Romania, the relevance of a work-based learning (WBL) approach, able to create opportunities and to strengthen cooperation between VET providers and companies became evident. According to the EQAVET Policy note of February 2015 "WBL has been proven to be a powerful instrument for developing curricula based on a competence model, supporting learners' motivation and achievement. WBL encourages the acquisition of practical knowledge and the right attitudes. It should be complemented by school-based learning which supports the integration of key and soft skills in the curriculum, as in the case of entrepreneurship skills. Models of WBL, such as apprenticeships (based on a dual system), can help correct the mismatch between labour demand and supply, as they meet the needs of employers, and the training is given in real jobs."

The Focus Group led to the involvement of a Higher Technical Education institute in Italy and six Secondary Technical, Theoretical and Economic Schools in Northwestern Romania.

Action Plans

The partner FVEM developed an Action Plan (AP) scheme to allow the GREEN STAR partners, VET institutions and schools to define, implement and report about the results of the adaptation by applying a structured and comparable methodology. The evaluation was designed accordingly (see chapter 4.3.2).

The Action Plan scheme considered the following items:

- Cover page
- Executive summary
- Index
- Profile of the organisation or project presenting the plan
- Management/governance information
- Problem analysis and solution analysis
- Work plan
- Summary of outputs and timeframe
- Summary of staffing and human resource needs
- Budget
- Appendices and supporting documentation.

Adaptation to company-based training

Each company, according to the internal needs analysis and the support by the reference partner in the respective country, developed a training programme general enough to be re-used at EU level and specific enough to be useful within the company strategic objectives. The Energy module was translated and applied from GT VET with no modification. The module Waste was adapted and updated (normative elements and standards adapted). The LCA module was newly developed through the cooperation between the company API and the research center Consorzio Venezia Ricerche (CVR). A sensitisation and training action of the LCA Module was carried out by Confindustria Veneto SIAV involving 25 companies in several seminars co-funded by a regional European Social Fund project.

The detailed description and the results are presented in chapter 4.4.1 – Energy, 4.4.2 – Waste; 4.4.3 – LCA, 4.4.4 – LCA in continuous training.

Adaptation to higher and secondary technical education

The ITS Meccatronico of Vicenza, based in the Veneto region (whose representative participated at the Focus Groups) agreed to test the LCA module within its course "Automation and Mechatronic Systems Technician". The learning methodology adopted a team assignment approach coupled with face-to-face training provided by API and CVR.

The CCI Cluj in cooperation with six secondary technical, theoretical and economic schools in Northwestern Romania tested Level 1 and 2 of the Energy module, as adapted and translated by SINTEROM. The detailed description and the results are presented in chapter 4.5.1 and 4.5.2.

Adaptation to an apprenticeship system

The Region of Veneto (within the legal framework described in paragraph 4.2.3), in cooperation with the training agency Forema (a silent partner), authorised the test of Level 1 and 2 of the Energy, Waste and LCA modules as adapted/developed by each company. The detailed description and the results are presented in paragraph 4.5.3.

4.3.2 Evaluation design

Alberto Vergani

Beside the integration of the internal and external know-how of experts through Focus Groups and Meetings and the literature review, the evaluation of different types of activities of the project (partnership and collaboration, project activities and outcomes) was one of the main methodological issues to guarantee the quality of the project's processes and results.

The evaluation focused on the following dimensions (largely envisaged in the approved proposal):

a) Meetings' and workshops' participants "perceived effectiveness" (such effectiveness relating both to meeting's and/or workshops' contribution in developing adequate skills and knowledge about energy, waste and/or LCA and to general interest and satisfaction for participation)
b) Action Plans *on-going* implementation (basically in terms of compliance between Action Plan expected and actual contents and implementation process)
c) *GT VET Blueprint model* transfer impact study (through the *Green Star* modules implementation based on organisation-specific Action Plans)
d) Partnership *Added Value* perception.

Each dimension of evaluation was carried out using a specific method, that is:

- "Perceived effectiveness" of the workshops participants in partners meetings and dissemination activities: Surveys with questionnaire, one for each project's *event*, were conducted after the events conclusions and the answers to questionnaires were analysed to produce coherent recommendations
- Action Plans on-going implementation: Also for this dimension a *survey* was carried out with the questionnaires filled in by each Action Plan manager
- Transfer impact study: This evaluation, the core of the evaluation activity, has been performed using different methods for Action Plans implemented by training providers and/or intermediate institutions and by companies. More detail on methods will be outlined further on
- Partnership Added Value Perception: A survey/questionnaire was implemented for this last dimension.

Considering the *transfer impact study*, which was the most interesting activity from a methodological point of view, it was based on the three following assumptions:

- An *instrumental* assumption: The *GT-VET model* transfer occurred through the *instrument* represented by *Action Plans* (one Action Plan for each *transfer* operation)
- A *context* assumption: The *transfer process* (and therefore the process-originated expected impacts) had a different profile and *perspective* - also for evaluation - if it took place in a company (where training was orientated to workers *up-skilling* was companies typical context of *continuous* vocational training) or if it was implemented by an institution[24] or a training provider (where training, delivered to never-employed but also to young employed or employed, was targeted at recipients re-skilling or *totally* skilling was done)
- An *evaluation logic* assumption: Being strongly linked to the transfer process profile, the impact evaluation - as already anticipated – was differently designed for company-based training processes, on one hand, and for institution or training provider-based training, on the other hand.

More specifically, two impact evaluation logics were adopted:

a) For institution or training provider-based training, the *transfer impact study* did not really consist in an ex-post impact study but (only) in a *survey* with questionnaires, carried out at training conclusion, asking recipients of perception training modules (young apprentices, employed workers, or students depending on situations) to assess, in quite a detailed way, the potential relevance and *contribution* of training contents with respect to their actual or future professional position or job
b) For company-based training, the *transfer impact study* was carried out as a *real* ex-post impact evaluation using a theory-based approach and specifically the *Contribution Analysis* approach (Mayne, 1999).

Concerning Contribution Analysis some brief explanation must be given here. *Contribution Analysis* (CA, henceforth) is a *theory-based approach* (which means it is not a counterfactual-based evaluation approach) whose main focus is on "causal process design" (Stern et al., 2012). This means that "the programme [the *Action Plan*, in perception] is regarded as a *conjunction* of causes that follows a sequence. [A process-oriented theory-based approach] follows the pathways of a programme from its initiations through various causal links in a chain of implementation, until its intended outcomes are reached. The process is built around a *theory* – a set of assumptions about how an intervention achieves its goals under what conditions [such a theory is therefore called a *theory-of-change*, TOC]" (Stern et al., cit., p. 25).

As for the Contribution Analyses (CA), "it is used to evaluate programs delivered in complex and dynamic settings by reducing uncertainty that a program is achieving its desired results (….). CA is particularly useful in circumstances where traditional experimental designs are not possible or entirely applicable. Related to this, a benefit of CA is its focus on examining supportive

[24] We include in such a definition different subjects like a Region (Regione Veneto), a tertiary non-academic training institution (ITS Meccatronico), a private training provider (SIAV), a chamber of commerce (CLUJ CC), a sector companies territorial representative federation (FVEM).

conditions or alternative explanations which affect program achievement and outcomes. …. The acceptance of non-traditional study design in growing … as they are particularly well suited to programs where outcomes are determined through stakeholder input and interaction, and is likely to be influenced by social structures and processes (….). CA involves developing a postulated theory of change to demonstrate how a program is expected to achieve results. Unlike traditional study design which attempt to determine causality, in CA cause-effect is addressed through 'contribution' [and not 'attribution' like in counterfactual, my note] using available data. To achieve this, Mayne proposes applying the concepts of plausibility, reasonable agreement, *embeddedness* and testability (Mayne, 2011) to systematically investigate the intervening steps in a program logic which are presumed to be responsible for achieving results" (Biggs and al., 2014, p. 215).

In operational terms, the application of the CA approach to each company which was based on the GREEN STAR training centered *Action Plan*, followed the process steps codified by Mayne which are the following:

1) Set out the cause effects issue to be addressed
2) Develop the postulated Theory of Change and risks to it, including alternative explanations
3) Gather existing evidence on the Theory of Change
4) Assemble and assess the "contribution story" and the challenges to it
5) Seek out additional evidence
6) Revise and strengthen the "contribution story".

The steps were implemented using different techniques (from document analysis, to in-company direct observation, to semi-structured/in-depth interviews delivered to Action Plan recipients and stakeholders) *kept together* through a specific evaluation *form* which was used both for carrying out the single *Action Plan Impact Contribution Analysis* (as a sort of guide-line) and for presenting the evaluation results. The *form* (in the Appendix) was structured in six sections each corresponding to one of the above illustrated CA steps; in addition a *preliminary* step, containing "Basic information about company and Action Plan", and a section with *Final Notes* were included in the form. In coherence with the CA approach, the sections focused on Step 2 (dedicated to the presentation of Action Plan's theory-of-change) and on Step 4 (aimed at assembling and assessing the *contribution story*) were the most relevant for Action Plan's impact evaluation.

4.4 Training Sub-modules / Case studies

The following chapter considers the results of the Action Plans undertaken to test the submodules adapted (Energy, Waste) or newly developed (LCA). Each experience includes a description of the company, the presentation of the Action Plan and its participants, the activities carried out and the conclusions/lesson learnt from the company. The full impact evaluation report is presented under chapter 4.6.

4.4.1 Energy

Alexandru Gaciu, Ioan Csep

The company: SINTEROM

SINTEROM (www.sinterom.ro) implemented an important investment program with European Funds, during 2013-2014 in technological equipment. The main equipment consisted of: one CNC 250 tones compact press for powder metallurgy, two conveyor belt furnaces with TPC (total process control) for iron powder items, one washing-deburring-drying equipment, one CNC lathe, one carbonitriding batch furnace, one 3-D Multisensor Measuring Machines. The main reason for this investment was to improve the quality of the products, to reduce energy consumption (electrical and gas) and to increase the capacity for production of powder metallurgy precision parts.

As a major consequence of the investment focus an action plan for improved energy management (gas and electric energy for one furnace and for the new press) coupled with an awareness and training action plan involving SINTEROM workers is presented in this chapter.

The action plan: Steps and participants

The purpose of the action plan is to improve the skills of participants regarding green knowledge, according to European experience following the GT VET results in the spirit of GREEN STAR. Additionally, there are some concrete actions already done which are included, based on an energy consumption reduction plan of the company with the target of 9% of savings per year.

In the company SC SINTEROM SA there were some actions concerning energy, in order to increase the level of consciousness in ecological ability. The target groups of this program were both workers involved in the production process (press machine setters, ovenmen, locksmiths, electricians) as well as students of the Technical University, practicing in the production department.

The existing production processes were approached in a new way whilst looking in terms of energy, on the types of used energies. In this approach, the target groups were informed about the consumed quantities of energy, their costs, and the importance of energy savings, and were thus oriented towards the search of possibilities to reduce energy and costs, both in the production process and in maintenance.

The instructions and the presented materials for the transfer of knowledge were elaborated, using as a guide the sub-module "Energy" of the GT VET professional training program, with its four knowledge levels, translated into Romanian language and distributed to the people involved.

Individual and group discussions were carried out in order to understand the phenomenon "Energy" and to have a better attitude towards the problems of its consumption and savings. Especially, the materials corresponding to the second and third level were emphasised in this respect. Performing settings for the measurement of the consumed energy quantities in the production processes

were delivered, comparing the old company equipment with the modern equipment of high energetic efficiency.

The evidence of the quantity of saved energy for getting the same product was shown, the difference of the energetic costs, the impact upon the environment. Discussions were held concerning the possibilities of reducing the quantities of consumed energy, done by different methods, such as the acquisition of modern technologies, the upgrading of the existing equipment, their correct operation, and the high class maintenance of the equipment to eliminate the losses.

The company holds an implemented program for the reduction of the energetic consumptions (The Program of Energetic Efficiency) taking into consideration all the possibilities of reduction in the production process, with nominated actor held responsible for each action. This program was presented, also, to the workers who were involved in the process that understood and accepted it as a task in order to make their personnel contribution to the achievement of the objectives.

All in all, 29 persons were trained at SINTEROM from the beginning of program (on the first and second learning level):

- press machine setters: 9 persons
- ovenmen: 4 persons
- locksmiths: 6 persons
- electricians: 5 persons
- engineers: 5 persons.

For the third and fourth level electricians and engineers with more experience and practice regarding energy were selected:

- The people concerned need to have more experience and skills to be involved in an efficient technological process, to be active in optimising the gas and electrical consumption and to transfer and implement new ideas to reduce waste energy and energy consumption.
- The final results of the team working in the GREEN STAR Project show a yearly total reduction of energy consumption within the existing program plan. For 2015 a reduction of 312 MWh is expected, equivalent to 22.065 Euro, around 9% lower than the total energy cost on 2014.

To adapt and transfer the GT VET sub-module "Energy" to the SINTEROM staff and to integrate it into the Energy Investment and Reduction Program the following steps of the Action Plan were conducted:

- Translation of GT VET Modul- Energy in Romanian language for 1-2 level
- Training of the all involved personnel in the project for 1 and 2 level using GT VET submodule energy
- Transfer of the information: definition of energy, transformation with examples, different sources of renewable and non-renewable energy (locksmiths, press setters and ovenmen)
- Conversion of energy, different types of energy, classification of energy sources, "matching the energy sources to pictures" (locksmiths, press setters and ovenmen)

- Transfer of information like: definition of energy, examples for the transformation of energy, different renewable and non-renewable energy sources (engineers, electricians)
- Conversion of energy, different types of energy, classification of energy sources, "matching the energy sources to pictures" to engineers, electricians
- Explanation of energy levels: primary energy, technical energy, efficient energy; different kind of sources: renewable and non-renewable; examples to save energy (locksmiths, press setters and ovenmen)
- Explanations for the energy levels: primarily energy, technical energy, efficient energy; different kind of sources: renewable and non-renewable
- Examples of the way to save energy; engineers and electricians
- Translation of GT VET Module- Energy into Romanian language for 3-4 level
- Training for the selected personnel for 3 and 4 level
- Energy calculation of cost and effectiveness. Measuring of different light sources. Comparing between different type of lamps (bulb, LED lamp, halogen and fluorescent)- engineers and electricians
- Optimising of hydraulic system with regulating pump of pressure by measuring the effective energy consumption on compacting mechanical-hydraulic press of 50 tones
- Level 4 - The know-how process with results of studying, basic information, data sheets, strategies for energy saving.

Technical actions

The training of the GT VET based sub-module "Energy" was based and took place in line with a fundamental update of the production technology, even from an environmental perspective.

The technological investment was made on the background of an energy audit. The main objectives of this audit, made before the investment, were:

- Estimating technical and evaluated energy equipment
- Setting absolute and specific quantities of energy analysed processes
- Evaluation of the possibility of upgrading the facilities, reducing operation and maintenance costs
- Improving the efficiency of electricity and natural gas
- Optimisation of heat treatment processes.

Based on this audit the plan of measures and actions for technical improvements could be summarised like this:

- Improving the operation of furnaces
- Optimal adjustment of burners gas installations AICHELIN
- Optimization of belts loading
- Heat recovery from flow gas - oven / AICHELIN
- Heat recovery from cooling water;
- Reducing pumping water for cooling tower.

Using modern equipment with TPC-new generation of conveyor belt furnace was done for:

- Elimination of endothermic gas reheating

- Reduce heat loss by combining blocks and walls
- Removing resintering by using TPC (Total Proces Control)
- Removing samples sintering
- Removing AICHELIN installations - electrical consumption
- Reduce maintenance costs
- Installation of additional skylights - natural lighting
- Dimming the Hall voltage interior lighting sintering
- Organising production - limiting number starts furnace.

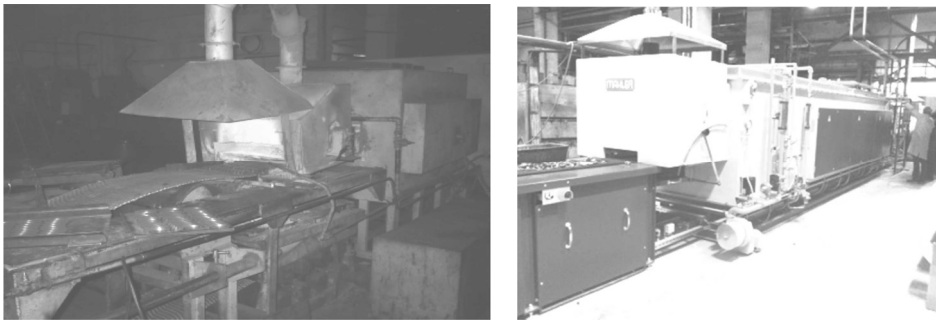


Figure 13 Old and new furnace, heating loss of old furnace

The advantages of using the new conveyor belt furnace are evident by comparing the specific consumptions of the old furnace with the new one: By increasing the production capacity from about 44 to 200 kg/h the electric energy consumption was reduced from 1,77 to 0,70 kWh/kg, the methane consumption from 2,816 to 0,575 kWh/kg. The cooling water consumption was also reduced from 2,7 m3/h to in between 1,5 to 2,0 m3/h.

The investment in the new equipment resulted in enormous energy and cost saving listed in the table below.

Measure	Economics / year			
	[MWh]	[t.e.p.]	[lei]	[euro]
Gas savings Optimal adjustment : AICHELIN burners	200,68	16,28	19.762	4.596
Electricity savings Elimination of endothermic gas reheating	83,51	7,17	26.306	6.117
Electricity savings Reducing heat loss through walls and muffles	79,53	6,83	25.052	5.826
Electrical energy saves: Remove several sintering	183	15,72	57.645	13.405
Gas savings (methane): Removing several sintering	348,4	28,27	34.310	7.980

Table 16 Energy and Cost Savings

Overall, the technological investment combined with the training of the involved workers and engineers led to the following benefits:

- Reduction of the specific energy consumption by using of a more efficient technology.
- Reduction of the energy consumption by reducing the need of resintering some of the parts.
- Reduction of methane consumption by including the cracking in the furnace design.
- Reduction of radiant and convective heat losses through the surfaces of the furnace.
- Reduction of the energy losses in the control cabinet.

Conclusions

The new generations of powder metallurgy equipment acquired by Sinterom in 2014 on a project based with European Funds, coupled with a specific sensitisation and training action funded by the Lifelong Learning Programme allows the company to be competitive in the terms of specific consumptions of gas, electrical energy and also in terms of quality for precision components with the destination of the automotive industry. Technological and human resources improvement led to an enormous saving of energy and cost pushing the awareness of the company and its employees at all levels for green skills.

4.4.2 Waste

Kepa Jon Arana, Joana Mielgo

The company: BRUSS Group

The company BRUSS Juntas Técnicas, part of BRUSS GROUP, is located in the town of Durango, Spain. Its main activity is the design, manufacture and sale of seals and gaskets for sealing engines, gearboxes and other components used in the Automotive Industry.

Innovation is something BRUSS takes particularly seriously by finding individual solutions, taking new paths and developing innovative products. BRUSS is characterised by a passion for automotive technology and a desire for perfection.

Some innovations are:

- Increased performance
- Improved product quality
- Reduced costs and handling
- Promotion of progress in the automotive sector.

The Action Plan: Steps and participants

Through the Action Plan the skills of participants regarding green knowledge on waste handling are to be improved, according to the recent European experience (esp. GT VET) in the GREEN STAR project, BRUSS focused on:

- Optimisation of rubber waste disposal: From current land-filling to reuse, recycling, and valorisation
- Industrial net philosophy according to ZeroWIN European networking project (www.zerowin.eu)
- Implication of all the personnel of the company in the development and daily application of the environmental system.

The following Action Plan steps were undertaken (details see table below):

- Selection of a specific problem: Waste
- Definition of a BRUSS project team: coordinator, analysis/documentation/ intervention and technical/contrast support (internal), environmental consulting technical/practical support (external)
- Review of existing experience by the project team (based on the waste module of GT VET)
- Identification of GT-VET elements adaptable to BUSS and identification of specific elements related to the location of BRUSS
- Preparation of training material
- Realisation of training activities.

Result Area: Upgrade of operators qualification in waste management **Indicator: Number of operators trained** **Progress indicator: Training certificate records for HR**		
Activities	**Time Frame**	**Person Responsible**
Review of GT VET experience in waste module	Month 1	Laboratory technician responsible for environment
Presentation and discussion about applicability	Month 1	Chief executive officer, laboratory technician responsible for environment
Material translation to BRUSS reality	Months 2 to 3	Training coordinator (external)
Legal aspects review, training experience checking	Month 4	Laboratory technician responsible for environment
Training material fine tuning	Month 5	Training coordinator (external)
Pilot training program preparation	Month 5	Training coordinator (external)
Pilot training	Month 6	Laboratory technician responsible for environment, training coordinator (ext.)
Review of the results and experience of pilot training	Month 6	Laboratory technician responsible for environment, training coordinator (ext.)
Adaptation of material to real experience results	Month 7	Training coordinator (external)
Training program execution	Months 5 to 7	Laboratory technician responsible for environment, training coordinator (ext.)
Conclusions	Month 8	Laboratory technician responsible for environment, Chief executive officer

Table 17 Action Plan BRUSS

The main features of the training programme could be summarised as follows:

- Focus on plant operators (blue collar), who are the people in direct contact with the generation and handling of waste
- Four established complexity training levels (see table below)
- Based on three hours training sessions (one theory hour plus two hours of practical exercise)
- Aligned with ISO 14.001 training requirement.

Level 1: What is waste?

TITLE	**WASTE AND ITS IMPACT**
LEARNING TARGET	– Define "waste" – Identify the different types of waste – Describe the different methods to eliminate waste – Define the concepts of the European Hierarchy in Waste Management
ACTIVITIES	– Quiz – Review at the shop-floor how waste is handled

Level 2: Waste treatment

TITLE	**TYPE OF WASTE GENERATED AT THE WORK PLACE**
LEARNING TARGET	– Environmental impact of waste – Accidental or improper handling generated issues – Procedures for waste recuperation or elimination – Waste producers identification
ACTIVITIES	– Discussion based in waste images

Level 3: Legal requirements

TITLE	**WASTE – LEGAL REQUIREMENTS**
LEARNING TARGET	– Legal structure – Generation and waste storage at production point – Legal requirements for waste producers – Legal requirements in waste management – Acceptance criteria for waste
ACTIVITIES	– Fulfil the different steps to correctly manage waste

Level 4: Analysis and improvement

TITLE	ENVIRONMENTAL EVALUATION
LEARNING TARGET	– Environmental management system – Identification of the environmental aspects – Environmental evaluation – Environmental objectives and targets – EMS model
ACTIVITIES	– Perform an environmental evaluation of an aspect related to the work place

Table 18 Training module contents (Waste)

Implementation

For each learning level BRUSS organised a training workshop and company tailored examples and exercises. In order to make clear the objective of each training to participants, the title was transformed into a guiding question. Below the programme proposed.

LEVEL 1: WHAT DO WE GENERATE?

Materials, substances or leftover objects of any operation, activity or production process.

- EUROPEAN NEST ON WASTE MANAGEMENT
  - Elimination
  - Valuation
  - Recycling
  - Neutralisation
  - Prevention

LEVEL 2: HOW TO TREAT THE WASTE GENERATED?

- RECYCLING:
  Submit a subject or a product already used to a course of treatment for a commodity or a new product.
- LANDFILL SITES:
  The spill is the elimination procedure that receives the largest amount of non-hazardous and hazardous waste (pre-treatment)
- INCINERATION:
  It is done in furnaces with (mainly) the use of the energy produced (energy recovery)

LEVEL 3: HOW TO MANAGE?

- OBLIGATIONS OF PRODUCERS:
  - Segregation
  - Packing
  - Storage
  - Labelling

- ADMINISTRATIVE MANAGEMENT
  (internal control system)
- WASTE MANAGEMENT:
  - Collection
  - Transport
  - Treatment

LEVEL 4: WHAT COULD BE IMPROVED?

- ENVIRONMENTAL ASSESSMENT:
  There are different "Basic Tools" that have been widely adopted in activities to improve quality and used as support for analysis, BRUSS uses the FMEA method (Failure Mode and Effects Analysis). This method allows:
  - Continuous improvement
  - Corrective action
  - Process control and design
- OBJECTIVES AND ENVIRONMENTAL GOALS

The prioritisation of environmental aspects will be conducted according to the obtained composite score, with a higher priority of the aspects with greater impact, lower cost and less difficulty to solve. Based on the study of the evaluation of environmental aspects, environmental objectives and targets, with corresponding action programs will be established.

In the elaboration of the objectives and targets the prevention of pollution in general and the improvement of activities, products and services (based on the results of the significant aspects shall be taken into account.

Conclusions

The main conclusions that could be drawn from the Action Plan results are:

- Waste sensibility at work place is lower than at home level. Waste is assumed as inherent to the industrial activity
- Operators are not aware of the complexity of waste management procedures
- Environmental related topics are of the interest of the majority of people who took part in the training modules
- Operators trained in the basic modules (module 1 and 2) have requested to be trained in advanced modules (module 3 and 4)
- The practical exercises performed after the theoretical presentation play an important role to fix concepts in the participants´ minds and behaviour. In each of the sessions this point has generated a “live” discussion among participants.

After the training program is finished, the impact of the activity in the environmental performance of the factory should be evaluated by:

- Audit of waste “quality” before and after (improvers measurement)
- Evaluation of spills situation in fluid waste areas
- Number of not or incorrectly labelled material at waste storage area
- Improvement proposals in waste management transmitted to environmental technicians after realisation of trainings.

4.4.3 LCA

Carlo Brunetti, Marco Meneghetti

The company: API

API Applicazioni Plastiche Industriali SpA is an Italian company, based in the Veneto region, involved since its foundation in 1956 in the plastic field. It is specialised in the creation, development and engineering of: Polymeric alloys and thermoplastic elastomers compounds, Thermoplastic Polyurethanes TPU, Biodegradable and Renewable Bioplastics, suitable for injection and co-injection moulding, extrusion, co-extrusion, calandering, coagulation, casting and blowing film.

Today the company is organized in three Business Units dedicated to different market sectors (Footwear & Sporting Goods, Automotive & Tech. Products, and Packaging & Healt Care).

API has always stood being able to supply top performance and easy to use materials, allowing the creation of highly innovative products. From a long experience in advanced sectors for the use of polymers, the company has developed an extensive knowledge of the interactive behaviour between families of polymers, and in today's challenging market, the company offers innovative "tailor-made" solutions for individual applications in a wide range of sectors.

Particular importance is given to the development of products with a low environmental impact. Careful selection of raw materials ensures that API can eliminate potentially dangerous components and enables the safe re-use of scrap materials as well as the handling of end of life materials.

What makes API truly unique in a context of compound producers is that it offers a complete range of TPE, PU and the latest Bioplastics: Biodegradable elastomers and bio-based polymers, in which the components are not from fossil origin but derive from environmentally friendly renewable sources which contribute to reducing greenhouse gas emissions and the carbon footprint. This sums up the company's strategy based on growth in advanced polymers with low environmental impact features.

With the aim to offer a wider range of bioplastic materials that can help the reduction of the CO2 emissions, API has just created new grades based on renewable raw materials (from agricultural origin). The content of these renewable resources can vary between 15 - 95% of the total components.

Because of API business focus on bioplastics, the application of the LCA method is quite useful and suitable for supporting informed decisions concerning the production and use of bioplastics in substitution of *traditional* plastics.

The Action Plan: Steps and participants

Life Cycle Assessment (LCA) is a methodology for evaluating all the **environmental impacts** associated with a product, considering its entire life cycle from the extraction of raw materials to production, distribution, use, re-use, maintenance, recycling and its final disposal. LCA procedure is standardised at international level by ISO norms 14040 and 14044.

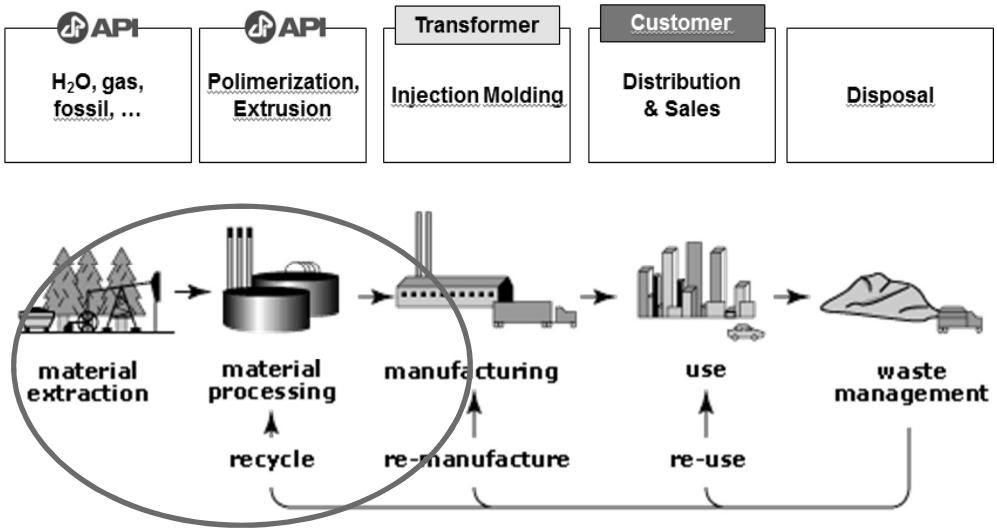


Figure 14 Position of API within a Life Cycle Analysis

The main phases of a LCA (described already in chapter 3.6.1) could be combined with the following activities:

1. **Goal Definition and Scoping:** Define and describe the product, process or activity. Establish the context in which the assessment is to be made and identify the boundaries and environmental effects to be reviewed for the assessment
2. **Inventory Analysis:** Identify and quantify energy, water and materials usage and environmental releases (e.g., air emissions, solid waste disposal, waste water discharges)
3. **Impact Assessment:** Assess the potential human and ecological effects of energy, water, and material usage and the environmental releases identified in the inventory analysis
4. **Interpretation:** Evaluate the results of the inventory analysis and impact assessment to select the preferred product, process or service with a clear understanding of the uncertainty and the assumptions used to generate the results.

An LCA can help decision-makers to select the product or process that result in the least negative impact to the environment. This information can be used with other factors, such as cost and performance data to select a final product or process.

The benefits of LCA are:

- Strategic re-positioning of the product
- Communication of environmental information that can be used to enhance the product
- Getting an eco-labelling (e.g. Ecolabel, Carbo footprint)
- Releasing Environmental Product Declarations (EPD)
- Improving technology strategies.

API applied the LCA method to measure and outline the environmental impacts of the production of two bio-based plastics namely by quantifying the use of oil (or other fossil-based derivate) and CO2 emissions. In both case they are inferior to products and processes using non bio-based plastics. LCA is therefore applied to products both with a Research and Development purpose (*internal* perspective) and in order to reply to customers' requirements for using bioplastic (*business* perspective, useful to valorize environmental benefits of a specific product).

The Action Plan refers to the business perspective. Through cooperation with the research center Consorzio Venezia Ricerche[25] (knowledge provider of the methodology, databases and software) the Action Plan considered two main dimensions:

1. The first focus is aligned to customer demand, in order to apply the model to a real case; this application involved the Business Unit Footwear.
2. The second focus is dedicated to involvement of the company's functions defined as stakeholders of the method's application, valorisation and use, namely Quality, Marketing, Sales, and Research.

The effects of the Action Plan were defined by the company as outputs:

a) The increase of knowledge and competences of the participants about LCA contents and benefits when applied to customer demand
b) A quantified and clear presentation to the customer of the degree of the environmental sustainability of their product and the related production process by comparing bioplastic and fossil-based plastic
c) The generation of new business opportunities in the short and medium run, thanks to the involvement of a wide range of company's levels and functions.

The Vice President of Innovation and the Product Development Manager verified the project feasibility evaluating the transfer of the LCA results into the business and operation company processes. Initially, due to its complexity, the LCA contents and results were spread to Business, Quality and Operation Offices. The Production Department has been involved only in the end, after translating the LCA concepts in a simple and easily understandable way.

The activities were defined according to the common Action Plan framework:

[25] The CVR, partially financed by public regional funds, closed during the AP implementation. The impact evaluation defined it as a potential risk of knowledge loss.

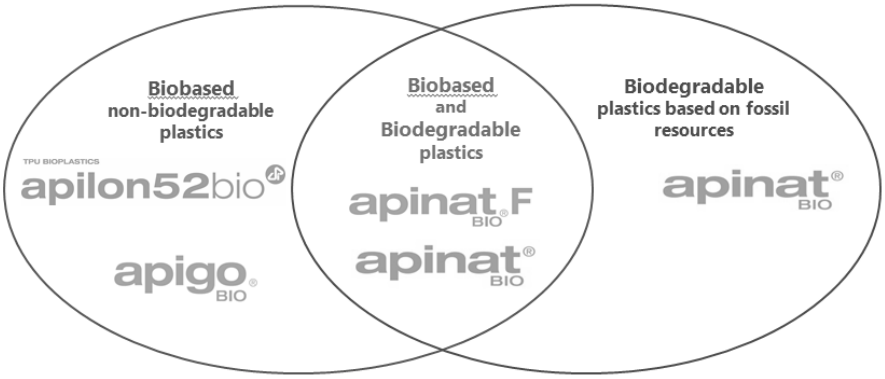
Activities	Time Frame	Person Responsible
Definition of the goal and technical elements of the LCA project	Month 1	Vice President Innovation / Product Development Manager
Assignment to CVR the LCA project. Information and technology sharing with CVR: mapping of the process and products	Month 2	Research center (CVR)/ TPU Technical Director/ R&D Technician
Information and technology sharing with a selected API Customer (Sustainability, Production, Logistic and Design Offices): mapping of the process and products	Month 2	Area Sales Manager/ Product Development Manager
Information sharing with CVR: customer facts and needs	Month 2	Area Sales Manager/ Product Development Manager
CVR LCA analysis: guidelines for conducting an LCA within the series ISO 14040 and 14044	Months 3 to 4	Research Center - CVR
Meeting with CVR and Quality/Business/ Marketing Offices to finalise measured results	Within Month 7	Area Sales Manager/Product Development Manager Marketing Manager/TPU Technical Director/Key Account manager
Meeting with the Customer and the Business Office to present and understand the final results (decision-maker step)	Within Month 8	Area Sales Manager/ Product Development Manager

Table 19 Action Plan API

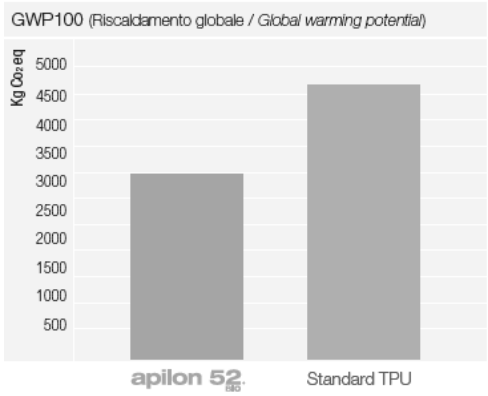
Technical actions

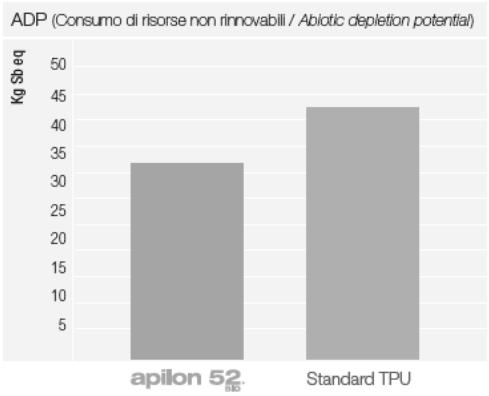
LCA has been applied to two API bio-based plastic products: APILON 52 BIO® (also used in automotive applications) and APIGO BIO®. In a context of compound producers, API offers a complete range of TPU, TPE, PU and the latest biodegradable elastomers to clients who demand tailor-made solutions and exceptional performance. Why use bioplastics instead of plastics?

There are two major advantages of bio-based plastic products compared to their conventional versions: save fossil resources for future generation and reduce green gas emissions. Biodegradability is an add-on property of certain types of bioplastics, which offers additional ways for recovery at the end of a product's life. The reduction of impact to environment through these technical approaches is demonstrated by the results of the LCA of two products APILON 52 BIO and APIGO BIO.



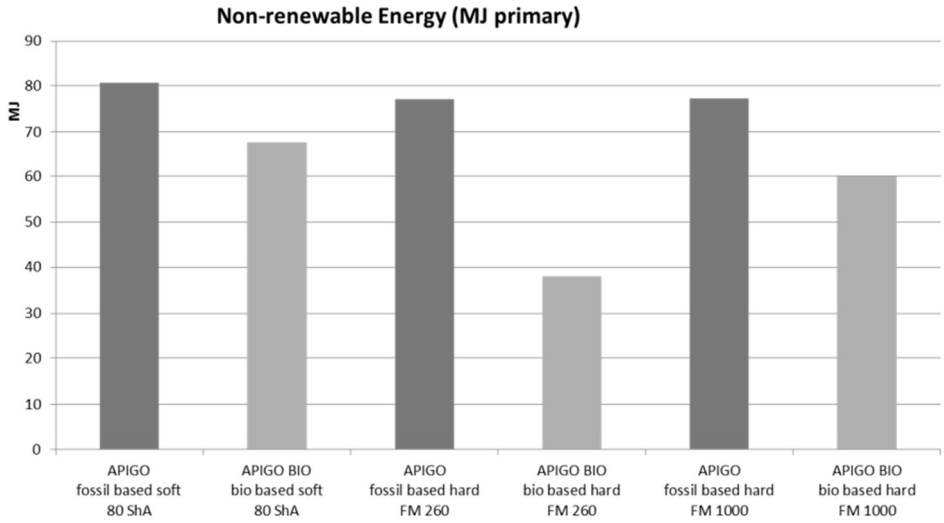
1. **LCA applied to APILON 52 BIO®** (Ester based Thermoplastic Polyurethanes from renewable raw materials)
   APILON 52 BIO is a biobased TPU with a renewable raw material content of between 30 to 40%
   Based on ISO 14040-14044 the LCA (Life Cycle Assessment) from "cradle to grave" of APILON 52 BIO provides (see figure below):
   - 36% reduction in greenhouse gas emissions - GWP (Global Warming Potential),
   - 25% saving in non-renewable energy - ADP (Abiotic Depletion Potential).





2. **LCA applied to APIGO BIO®** (TPO Compounds from renewable raw materials)
   SOFT GRADES:
   Hardness in the range 70-90 ShA (ASTM D2240)
   Flexural modulus: < 20 MPa (ASTM D790)
   Bio mass content: 20-30%

HARD GRADES:
Hardness in the range
40-66 ShD (ASTM D2240)
flexural modulus:
120-1000 MPa (ASTM D790)
Bio mass content: 30-100%



Conclusions

First, short term outcomes were achieved: The company managers participate in an application of LCA, understanding the meaning and the benefits, increasing their competences and thus the competitive advantage toward the customers and within each functional unit.

Intermediate outcomes are going to be achieved after September 2015 and are directly influenced by the Action Plan activities: The customer interested to use a bioplastic is able to get a clear and quantitative evidence of the positive environmental impact of the material.

Last but not least, a further Action Plan is necessary, although not a sufficient condition to reach the long-term objective: The increased customer value proposition and the optimised use of the LCA method by each unit of the company generates increased market potential opportunities and strengthen current markets shares.

4.4.4 LCA - Continuous training

Gabriella Bettiol, Chiara Salatin

An Action Plan for continuous training was carried out by Confindustria Veneto SIAV within the framework of a European Social Fund initiative "Networking for Competitiveness" financed by the Region of Veneto to support innovation for smart , sustainable and inclusive growth in manufacturing system.

The Action Plan: Steps and participants

The Action Plan had the objective to test the transferability of the submodule LCA developed by API and CVR in continuous training activities to other clusters and sectors.

The Head of Knowledge and Innovation Unit identified the regional ESF initiative as coherent with the module objectives. SIAV organised 6 workshops and 37 action research and action learning activities involving 37 companies and 197 participants within the project "Smart Innovation: application to the home appliances cluster".

Three sessions were organised in March and April 2015, with each session lasting 2 hours and it was then subsequently integrated into three workshop dedicated to smart and sustainable growth. 28 participants from 25 companies underwent a reduced version of the LCA module Level 3. Two trainers were selected from a certification organisation and an environmental services company. The selected trainers provided ad-hoc learning materials to introduce LCA and environmental communication tools, namely:

- environmental product declaration
- carbon footprint
- environmental claims
- case studies of energy efficiency and LCA applied to manufacturing processes.

The participants expressed their feedback through a dedicated questionnaire. The whole Action plan covered a five months time lapse.

Conclusions

The impact evaluation questionnaires and the informal feedbacks confirmed that the companies discovered LCA as a useful new issue to be included in continuous training, also through specific action learning activities. The reduced version proposed was considered sufficient to introduce the issue and raise awareness. Two out of the three sessions were evaluated against dedicated questionnaires, which structured results are available in chapter 4.6.

4.5 VET System Implementation

GREEN STAR modules were also applied to higher technical education and to the apprenticeship system. The Energy module (Levels 1 and 2) was tested in Romania, the LCA module in higher technical education in Italy and all three modules (Levels 1 and 2) were then tested in Italy in the apprenticeship system. In the following sub-chapters each experience is briefly outlined. A full impact evaluation report, including the companies' case studies is available in chapter 4.6.

4.5.1 Transfer of the Module to Higher Technical Education in Italy

Giorgio Spanevello, Cristina Toniolo

The ITS Meccatronico, following to the participation of the Focus Groups in Germany and Romania, agreed to develop an own Action Plan in order to test the introduction of LCA module within its programme, as there are no productive or service activities up to date that can ignore the environmental culture of their employees.

Profile of the organisation implementing the plan

The Decree of the President of the Council of Ministers (DPCM) of the 25th of January 2008 established in Italy the Higher Technical Institutes (ITS), "High Technological Specialised Schools". These schools are designed to respond to enterprises' needs and requests for new professional profiles with high-level technical and technological competences. The ITS Meccatronico Veneto is structured as a "small polytechnic" school specialising in mechatronics, with a diversified training offer characterised by an high percentage (at least 50%) of work-based learning and by a teaching/training methodology focused on project management activities, simulations, and laboratory sessions. The ITS is structured as a participatory foundation.

The implementation steps

The LCA module (Levels 1-3) was delivered to the students of the course "Automation and Mechatronic Systems Technician" at the ITS Meccatronico Veneto, as part of the Team Working module.

The Team Working module is an innovative training/teaching methodology (adopted from German and Dutch experiences), which aims at developing the "Training for Skills". Teams of 5/6 students with homogeneous competences are challenged to develop a number of projects from the design phase (including budgeting) to the implementation in a laboratory session,

in order to develop and industrialise the idea generated by the team. The students' performances are evaluated by a Commission. The results of the evaluation process are part of the overall grades of the academic year.

The Team Working module is composed of a total amount of 240 hours, including face-to-face lessons or debates. Parts of the hours are dedicated to students' training activities on theoretical aspects of the project management, as lean production (A3 design). Hence, the LCA module was included in Team Working programme.

Features of the training programme

The ITS Meccatronico defined a team responsible for the Action Plan implementation, composed by the Director of Fondazione ITS Meccatronico, the Courses Coordinator and the Business Communication Manager. The team was supported in training by the Product Development Manager of API, the former Director of Consorzio Venezia Ricerche, and an environmental consulting company.

Two sessions (of 8 hours) were organised: In the first session (April 2015) the trainers shared the basic theoretical concepts and the related practical applications to a business case study; the second one (May 2015) provided an overview of the certification process (stakeholders, rules, audit) and an application exercise (analysis).

Conclusions

The students understood the basic concepts of LCA methodology and its applications. They were involved in the impact evaluation activity, whose results are described in chapter 4.6. Additionally, under the evaluation is the possibility to include the module within the training programme of the ITS, although some contents shall be aligned with the specific objectives of the course. The presentations of companies' case studies connected with the course (e.g. Mechatronics) could be useful to facilitate the knowledge/application of the LCA methodology to a diverse range of production processes.

4.5.2 Implementing the Energy Module in Secondary Technical Education in Romania

Elisabeta Dumitrescu

The Action Plan concerning the integration into the Romanian vocational education system consisted of a transfer of the GREEN STAR and GT VET "Energy" sub-module to the students of six High Schools (Technical, Theoretical and Economics), which the Chamber of Commerce of Cluj (Cluj CCI) has concluded a Cooperation Agreement with. The training program with the high schools was developed under the project "***Students Training for Starting and Managing a Business***", financed through the Sectoral Operational Program - Human Resources Development.

The Cluj CCI, together with four partners, organised specific training sessions aimed at developing entrepreneurial skills among 520 students.

The Action Plan was implemented in six high schools and the seminars were attended by 190 students (27 in Cluj, 25 in Bistrita, 54 in Carei, 20 in Zalau, 23 in Oradea and 41 in Baia Mare) within six implementation steps:

1. Selection of the specific module – *Energy*
2. Concluding the agreements with the six High Schools
3. Testing the students' abilities
4. Dividing the students into two groups according to their potential:
   Students to be employed in the companies
   Students with entrepreneurial skills
5. Seminars focused on business development
6. Follow up activities to get the efficiency and feedback of the services.

Features of the training program

The training program was implanted as 3 hour sessions (1 hour theory and 2 hours practice). The training module contents:

Level 1 – Forms and sources of energy

Learning outcome: students are able to define energy, energy conversion, sources of energy, distinguishing between renewable and non-renewable energies and can explain their efficiency.

Level 2 – Energy sources, efficiency and saving

Learning outcome: students know different levels of energy and sort them according to energy sources and also get to know possibilities of saving energy.

Conclusions

The main result was the awareness raising among all these high schools students regarding energy savings. The students attending the training were tested, according to the national methodology, in order to measure their achievements:

- 92 % of the students can distinguish between different forms of energy
- 88 % of the trainees know different levels of energy and can sort them into energy sources
- 85 % are able to identify possibilities to save energy.

Additionally, the schools confirmed the content (according to levels of the sub-module "energy") fits to the general training.

4.5.3 Apprenticeship System

Roberto Baldo, Valentina Maistrello, Chiara Salatin

In June 2014 Forema, part of Niuko - the largest training company of the Confindustria scheme, participated in the Focus Group in Dortmund, where ThyssenKruppSteel shared its successful experience in applying the GT VET sustainable module to its apprentices.

After being included as silent partner in November 2014, Forema, the Region of Veneto and Confindustria Veneto SIAV designed the Action Plan in order to

transfer the three Green Star modules Energy, Waste and LCA within the regional apprenticeship training module "Social and civic competences-advanced".

The implementation steps:

1. Compliance check by the Region of Veneto
2. Selection of the levels to be tested according to the time schedule of the course
3. Formal approval of the testing by the Region of Veneto
4. Identification of the apprentices group and selection of the trainer
5. Delivery of training (8 hours)
6. Impact evaluation questionnaire.

Features of the training program

Within the 40 hours advanced course for social and civic competences, 8 hours in May 2015 were dedicated respectively to:

- Energy Levels 1 and 2: 4 hours
- Waste Level 1: 2 hours
- LCA Level 1: 2 hours

The 17 participants were aged 18-29 years old. They work for industrial companies in the Province of Padua, pertaining to *different sectors*. As the apprenticeship programme is a general one, it was deemed necessary to involve companies, not exclusively from the automotive cluster. The methodology used is a face-to-face seminar, including short debates among participants and trainer.

The modules contributed to develop the competence "To work in the company by contributing effectively and proactively, by taking responsibility and autonomy according to the tasks and the role assigned." More in detail, the targeted knowledge (K) and skills (S) are:

- Rules on the protection of health and safety in the workplace (K)
- Types of organisational models (K)
- Adopt behaviours that promote energy efficiency and environmental sustainability in compliance with current regulations(S)
- Identify the roles and the functions of a company's organization (S).

Apprentices were asked to provide feedback through a questionnaire, whose results are described in chapter 4.6. Moreover, an informal feedback was provided by the trainer.

Conclusions

The lower levels of the modules (1 and 2) are *applicable to a wide range of industrial sectors*, are well balanced in terms of timeframe in order to raise awareness about the content and to fit within the general training programme. The contents were particularly appreciated both from apprentices and the trainers as they are immediately applicable on the job, although impact in the short and medium run depends from the company organisational habits.

4.6 Impact Evaluation: Results of the Green Skills Implementation

Alberto Vergani

The evaluation result presentation will focus only on evidences coming from the Action Plan implementations and therefore (see the GREEN STAR evaluation design in chapter 4.3.2) on GREEN STAR modules *potential* impact for institutions and training providers based Action Plans, on the one hand, and on in-company training modules ex-post impact for company-based Action Plans. It is however quite easy to understand that, in coherence with GREEN STAR aims and objectives, the evaluation carried out on Action Plans implemented in companies has been quite challenging and its results deserve more attention than those concerning Action Plans implementation in institutions and training providers.

Beginning with **institutions and training providers'** questionnaires on recipients *potential (perspective) use* of training modules contents, the main evidences for the three sub-modules are the following:

- **Energy module** (which has been delivered by three providers, two Italian and one Romanian, all in all 62 respondents): Module contents were considered *new* by students while employed (also apprentices) affirmed they largely knew them; anyway, module contents appeared to be quite interesting, clearly understood in their core-topics and supported both by clear presentations and by a right module duration. Module perspective usefulness was judged, both by employed (also apprenticeship) and students, as mainly depending on individual jobs and responsibilities but respondents believed contents were in any case quite useful for *finding* a job even if "important but not necessary" for their professional future.
- **Waste module** (delivered by one provider, Italian, all in all 15 respondents): Among respondents, all of them apprentices, the module contents were rated as "mostly *already known*" but largely coherent with their jobs and generally interesting. The module duration was considered "right" and its usefulness was judged as relevant for the professions/occupations in general but also quite useful for the actual jobs of the recipients in particular. To master module contents was believed as giving "*in theory* a competitive advantage" compared to *colleagues* who did not attend the *module* but more companies' interest on module topic is needed.
- **LCA module** (delivered by 3 providers, all Italian, all in all 51 respondents): The module contents were largely new both for students and employed; they have been generally judged as *interesting* and with the right duration (although for employed more time was needed). Contents perspective usefulness was rated (again) as mainly depending on individual jobs but, in general, basics knowing about LCA was considered useful and quite important even if not necessary for professional future (students) or in the actual working position (employed). Nonetheless, basics on LCA are

considered to give a "competitive advantage" compared to *colleagues* who did not attend the *module* (but this was less *true* for apprenticeship).

In conclusion, what emerges from questionnaires on the perspective use of module contents is – trying to generalise the three different modules – that, on the one hand, *students* tend to consider the *knowledge* of modules contents as important for their professional future but cannot prove this assumption with *reality data* coming from direct work experience. On the other hand, employees' more or less positive opinion about the perspective use of module contents largely depends on individual jobs (positions, responsibilities, etc.) and on respondents working experiences (which are generally limited for apprentices and progressively increase for the other responding employed).

Moving now to **company-based Action Plan implementation** (three companies were involved, one for each project country), some common *impact* evaluation evidences[26] may be here summarized as a starting point:

- The Action Plans contents almost totally coincide, with the exception of one company, with the adaptation of the GT-VET training modules (Waste and Energy) or of a new GREEN STAR LCA module: In general, training modules have been delivered – with different recipients composition and quantity in each company – to employees who, because of their positions and responsibilities, seem to be able to support, foster and facilitate the Action Plan implementation outcomes both from individual to company level and from immediate to intermediate and long-term perspective.
- Long-term outcomes (which are considered in Contribution Analysis approach as the *real* impact of Action Plan implementation) appear to be quite significant in terms of (mainly potential: see below) profile and strategic relevance although their verification has been partial because the time-span between the Action Plans implementation conclusions and their evaluation was, also due to GREEN STAR closing deadline, shorter than needed.
- Long-term but also, partly, intermediate outcomes have quite different contents and profiles (see table below). They include, depending on each Action Plan and related company, elements concerning not only training direct recipients but also the company level (as a whole or as specific units or departments). The single company balance between these two *components* mainly depends on the possible integration between Action Plan and other company-based interventions (already implemented or under implementation) which cover technological, organisational or process issues and are oriented to the achievement of the same Action Plan outcome(s).
- The variables, in each company, intervene between the Action Plan implementation and its outcomes *production* increase by number and relevance passing from immediate to intermediate to long-term outcomes. This trend, combined with the observation for which Action Plan training modules contents are generally introductory and basics (although quite

[26] Remember that the term *impact* is here used within the methodological framework of the Contribution Analysis approach illustrated in chapter 4.3.2.

consistent in duration for levels 3-4), *causes* a progressive diminishing of the training modules contribution when passing from immediate to intermediate and above all long-term outcomes.

- The assumptions and risks accompanying each Action Plan *theory-of-change* (see below for detail) are not banal and expected. In fact, they *de facto* modify, through a re-definition and a critical re-shaping, the absolutely linear and direct structure that, at least conceptually, represents the *results chain* which links the Action Plan outputs with its different levels of outcomes.
- Also each Action Plan *alternative explanations* (again: see below for details) aimed at putting under examination and discussion the Action Plan assumptions describing the way the Action Plan itself should operate for producing the expected outcomes, give evidence (together with the already mentioned "influencing factors") of the high complexity, characterising the relationship between each Action Plan (both for implementation and results), its company context and the internal and external intervening actors and stakeholders system.

The table below is containing each Action Plan *Theory of change* and specifically the *results chain* characterising each Action Plan. It makes clear, for each company, the *hypothesized* links between Action Plan outputs (deriving from its implementation) and its different *level* of outcomes (where final or long-term outcomes are, as already highlighted, those which mostly identify *impacts*).

Outputs	Short-immediate outcomes	Medium/ inter-mediate outcomes	Long-term/ final outcomes
Company A (LCA)			
Meetings and lessons; documents; analysis report; training attendance (company employees and customers' employees); external consultants and technicians participation	Increase of both companies and customer employees´ knowledge/under-standing of LCA method contents and benefits; customer's acquisition of documented evidences concerning its product environmental sustainability	Customer's order acquisition by the company (the customer is the one involved in the Action Pan	New customers and/or orders acquisition and therefore company's turnover's increase

Outputs	Short-immediate outcomes	Medium/ inter-mediate outcomes	Long-term/ final outcomes
Company B (Energy)			
Level 1-2 module trained employees; Level 3-4 trained employees; training hours delivered for each module level; level of satisfaction for training; trainees self-perceived learning achievements	Energy consumption reduction of 312 MWh equivalent to 22.065 Euros saving which is around 9% of 2014 total energy cost (due to new technological solutions); increase of training recipients skills and knowledge in energy saving and energy efficient use; training recipients direct involvement in the implementation of efficient technological and production processes	Consolidation of energy consumption reduction by 9% a year; training recipients active contribution in optimising gas and electrical consumption; training recipients increase of activation and involvement in generating new ideas for reducing energy waste	Further consolidation of energy consumption reduction by 9% a year; increase of efficiency in production processes and therefore of general company competitiveness; increase of company revenue generation capacity

Company C (Waste)			
Level 1-2 module trained employees; Level 3-4 trained employees; number of training hours for each module level; level of satisfaction for training; trainees' self-perceived learning achievements	Increase of training recipients knowledge and understanding of waste management complexity and of environmental impact of workplace activities (also at individual level); adoption of environment friendly working practices (at individual level)	Improvement in waste elements classification (individual and organisation/unit level); involvement of trained employees (4 levels module) in the definition of waste management improvement actions (supporting and integrating *environmental technicians* who until now have been the only responsible for improvement actions)	Improvement of Waste Quality Audit results (after vs. before training); reduction/ diminution of spill situations in fluid waste areas; diminution of no/ incorrectly labeled materials numbers in waste storage areas; increase in waste management proposals number from trained employees to environmental technicians (as a consequence of an improvement of knowledge and awareness about waste management; correctness and compliance to existing norms and regulations)

Table 20 Outputs and outcomes of the training modules

The table here below shows the most important results of Contribution Analysis (CA) approach application to the three company-based Action Plans are presented. The table, a key-table for Action Plan *impact* evaluation, shows – as partly already introduced - that short-immediate outcomes have been largely achieved with a relevant Action Plan contribution while intermediate and long-term outcomes have been reached by one Action Plan or company and with a lower, as expected, Action Plan contribution (the other two implementations were concluded from a too short time for a sound intermediate and long-term outcomes evaluation): In fact, *time is needed to catch impacts because time is needed to produce them*.

	Short-immediate outcomes	Medium/ intermediate outcomes	Long-term/ Final outcomes	Notes
Company A (LCA)	Achievement[27]: 5 Action Plan contribution[28]: 100%	Achievement: 5 Action Plan contribution: 50%	Achievement: 2 Action Plan contribution: 30%	Action Plan implementation concluded in May 2015
Company B (Energy)	Achievement: 3 Action Plan contribution: 100%	Achievement: too early for this type of outcome Action Plan contribution: NA	Achievement: too early for this type of outcome Action Plan contribution: NA	Training module level 1-2 delivered by 6/2015; level 3-4 delivering to be concluded by 11/2015
Company C (Waste)	Achievement: 5 Action Plan contribution: 100%	Achievement: too early for this type of outcome Action Plan contribution: NA	Achievement: too early for this type of outcome AP contribution: NA	AP implementation concluded in July 2015

Table 21 Outcome achievement and Action Plan (AP) contribution

Within the implemented evaluation approach (see chapter 4.3.2), the internal *tightness* of the results chain (and therefore the possibility that, for each Action Plan, the envisaged chain really turns into reality) is, on the one hand, based on some assumptions which should make the chain *sound* and plausible and, on the other hand, is at the same time challenged by risks, alternative explanations and influencing factors which may *interfere* with the chain operation and, more specifically, with the Action Plans *implementation mechanisms* producing the different levels of outcomes. All these elements are therefore crucial parts both of the evaluation model and of its application results.

Beginning with *assumptions*, related to each level of *results chain*, they may be divided in the following groups (we consider them as a whole without making explicit the Action Plan they refer to):

- Assumptions regarding training recipients motivations, involvements, attitudes, interests in *translating* training achievements in working processes and contexts;
- Assumptions regarding the existence of organisational conditions able to support the outcomes progressive generation;
- Assumptions regarding the *coherence* between training contents, company's contexts and processes (both general and specifically linked to training contents), training recipients roles and responsibilities;

[27] From 0 (Absolutely no) to 5 (Totally).
[28] From 0 to 100%.

- Assumptions regarding the integration of training modules within a wider company strategy focused on training contents as well;
- Assumptions regarding the possibility that each outcome level may in short time produce tangible evidences of its benefits for the company.

Moving to *risks*, again related to each level of *results chain* (and therefore *counterbalancing* assumptions), some of them, in particular those linked to immediate and intermediate outcomes, correspond – in a negative way – to assumptions regarding the (non) existence of individual and/or organisational conditions or requisites able to support the expected outcomes *production*. In addition, for intermediate and long-term outcomes, risks may be mainly found in intervening variables and factors external to the company; these factors typically regard public policies influence, the role of competitors, modifications in company's provision or destination markets, customers' decision taking logics and timings.

Individual, organisational and external contexts levels are also, together with the possible interrelations among them, the *places* where *alternative* (to the proposed *results chain*) *explanations* for the outcomes production may be found. These *alternative explanations* refer to elements other than the Action Plans (and therefore other than training modules) which may have *caused* or *co-caused* the different outcomes. For this reason, all the identified explanations (their identification being a crucial part of the Contribution Analysis approach) are focused on elements which are relevant for the outcome production but are (for GREEN STAR) different from training contents. Examples of such elements, which strictly depends on modules topics, are the following: Already introduced (or being under-introduction) technical and process innovations produce energy saving effects whose entity do not depend on employees skills and knowledge (for energy module); training recipients´ professional backgrounds already include energy saving and efficiency skills (for energy module); final energy consumption reduction is produced by technology and/or process innovations only (for energy module); training recipients of LCA use skills coming from their direct co-operation with employees who already use LCA or from individual studies (for LCA module); customers' orders do not include LCA results in their decision making processes (LCA module); national or EU level obligations in using biomaterials *necessarily* bring new customers (LCA module); every-day work with experienced and environment responsible colleagues develops correct waste management knowledge and skills (waste module); an increase in management and supervisors control on waste management provokes correct behaviours and practices in *blue collars* (waste module); risks of being fined (or having been fined) for incorrect waste management produces more severe company internal regulations and monitoring (waste module).

These *alternative explanations* are obviously linked with the Action Plans *implementation mechanisms* aimed at producing the different outcomes. Looking for a common synthesis to the three Action Plans, these mechanisms were the following:

- training modules participation (with differences in-depth for levels 1, 2, 3 and 4 trainees and for trainees profile and company *role*) develops in recipients (mainly company's employees but also, in one company,

external subjects such as customers) specific learning achievement and/or awareness concerning the module´s main topics;
- after training, employees (especially those involved in levels 3-4 modules) implement working behaviours and practices coherent with training contents and able to positively integrate with other company policies and/or interventions focused on the same issues; in alternative, after training, training recipients are (simply) better informed or aware about specific aspects developed in the module;
- after being trained employees (or others) behave or operate in a way coherent with training contents, a number of mainly organisation based positive outcomes related to training topics occur (related to waste management, energy consumption reduction and LCA: for detail see above these *positive* outcomes).

Action Plan implementation mechanisms and the alternative explanations above are both conditioned by some *influencing factors* which partly look like the *risks* already illustrated and partly are *original*. These influencing factors emerged from the *field* may, again, be grouped in individual, company (or specific *internal* unit or divisions: processes, technologies, products or services), contexts (external: policies, markets, competitors, cultural processes) and relational level factors.

In conclusion, the table below tries to keep together the three variables which played the *evaluation game* and its main results presented:

1. Action Plan ownership (a training provider, an institution, a company)
2. GT-VET (or new) training modules general objectives (skilling, re-skilling or up-skilling)
3. Progressive levels of Action Plan related (expected and actual) outcomes.

	Kind of skilling	**Immediate outcomes**	**Intermediate outcomes**	**Long-term outcomes**
Training providers	Skilling or re-skilling		X	X
Institutions	Skilling or re-skilling	X	X	X
Companies	Up-skilling	X	X	

Considering the two outcomes (impact) evaluation *logics* which have been used in *GREEN STAR*, it may be concluded that:

- the outcome evaluation which covered training providers and institutions-based Action Plans included all the expected outcomes (although with some differences between training providers and institutions) but evidences, being based on recipients self-perceptions, are quite partial and incomplete;
- the outcomes evaluation referred to company-based Action Plans showed, not only because of the project time constraints, a concentration of Action Plan related outcomes on immediate and intermediate terms but with evidences coming from a quite sound evaluation process.

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5

Green Skills: Future Relevance and Policy Recommendations

Gabriella Bettiol, Chiara Salatin, Tommaso Grimaldi, Giulia Meschino, Antonius Schröder

It is widely recognised that the opening to a green economy would lead to new frontiers in labour markets, highlighting the great growth prospects and the possibility of eco-Europe becoming a world leader in the industry sector, consequently creating opportunities for new jobs of quality. The Parliament, on 12 December 2013, in its resolution "Eco-innovation - and jobs growth through environmental policy" proposed special recommendations for a socially responsible transition towards high-quality green jobs. Member States should make use of the European Social Fund for programmes aimed at up-skilling, training and retraining employees. The Commission and the Member States are invited to intensify their actions for the full implementation of the proposal in the context of the 2020 Strategy and to build a common vision on the different strategic opportunities that eco-innovation provides for the future. At national level Member States are advised to develop strategies to align the skills of the workforce with the opportunities offered by the sector of green technology. This is by examining the different sub-sectors and their needs for skilled labour, recommending promotion of the creative and innovative potential of young people to contribute sustainable development and improving their access to finance. Cooperation between Ministries and politics at any level is encouraged also to periodically monitor the implementation of relevant policies and to support regional partnerships for growth, innovation, employment and equal opportunities between women and men as well as cross-border initiatives.

The European Commission supports a plan of action invoking green SMEs about the possibilities of growth and the reduction of production costs from the transition towards a green and resource energy efficient economy (European Commission, 2015). It lays down a set of objectives and initiatives taking into account the results obtained from the public consultation (Green Action Plan held in the fourth semester of 2013) to be implemented at European level under the 2014-2020 multiannual financial framework. The Green Action Plan for SMEs

proposes to exploit the business opportunities that the transition to a green economy offers, by improving productivity and driving down costs in European SMEs through resource efficiency.

Priority is given to the creation of an economy based on knowledge and innovation; it should be more resource efficient, greener and more competitive and conducive to social and territorial cohesion through the achievement of a high occupancy rate. These development initiatives introduce a new system of economic growth based on a reduced use of materials and the reuse ("circular economy"), gradually replacing their previous model based on the "take-make-consume and dispose".

The ambitious program suggested by the Commission shows a significant potential for creating new jobs in the production of energy from renewable sources, energy efficiency, waste and water management, air quality, restoring and preserving biodiversity, climate change adaptation and the development of green infrastructure. The Commission provides a number of tools to enable SMEs to initiate a smooth transition to the green market, offering tools of support at both national and European level. It encourages:

1. Provision of European SMEs practical information, advice and support on how to streamline its management with a favourable cost-benefit ratio
2. Promotion of efficient mechanisms of transfer of green technology
3. Facilitation of access to finance in order to achieve improvements in relation to the resources and energy efficiency in SMEs.

Do these kinds of promotion already support the GREEN STAR approach? The following issues are also a ground for the project activities:

1. Promotion of all forms of eco innovation, including "eco-innovation not technological"
2. Promotion of partnerships between businesses, knowledge and skills for green entrepreneurship
3. Better use of the role of clusters in support of eco-innovative SMEs.

The European Commission states that action by the EU should focus its attention on competency gaps to be filled, on the anticipation of change, on the transaction and promotion of mobility, on the incentive to create new jobs and, finally, on increasing the quality of the data through:

1. Overcoming systemic obstacles that hinder collaboration in the value chain between sectors and between countries and business start-up and cooperation between them, facilitating the creation of models of service businesses and the reuse of materials, products and waste
2. Promotion of intersectional collaboration in order to promote circular economy
3. Promotion of a greener European internal market
4. Facilitating access to international markets by green entrepreneurs
5. Promoting the adoption of technologies for efficient resource management in partner countries through cooperation with European SMEs.

The European Economic and Social Committee (EESC, 2014) has issued its opinion in response to the Commission´s communication, which expresses the

commitment to transform the idea of a *circular economy* into reality in order to eliminate waste.

The Committee, confirming the advantages resulting from the development of a green economy and the important goals of "Strategy 2020" that can be achieved through it, puts the focus on the relationship between the vision of public and private entities, advancing the idea of a consensual transaction in the transition to a 'circular economy, through coherent and effective policies at European, national and regional level and with the involvement of all of civil society.

The Committee supports the proposals of the Action Plan for green SMEs and green initiatives to support employment, and calls for the implementation of concrete measures and guidelines to support SMEs to become more sustainable and environmentally friendly, identifying the achievement of this innovation facilitated by the EU application of predetermined criteria in identifying specific areas of action.

The Committee recognises a primary role in education and training as a prerequisite for lasting interaction with the world of work and business; offering the provision of assistance and tutoring to micro, small and medium enterprises through networks and centres of excellence and the funding and support for training, which would allow higher growth in national and international markets.

A key element of the measures proposed in green skills was the funds made available by the EU in the various sectors and how their use can be made efficient and specifically aimed at the creation of such targets. National policies would have the task of making the learning of this knowledge economically accessible to the subjects already entered the world of work, both for the students, encouraging them to undertake the study of disciplines that can provide them with high-level skills on reducing emissions of carbon dioxide.

The GREEN STAR approach is evidently based on the European policies and strategies described previously: GREEN STAR gives attention to the SME, cluster and value chain related improvement of green skills, based in a regional development of human resources within partnership between companies, public authorities, educational and vocational institutions as well as research institutions. Taking into account the GT VET training module and integrating the knowhow of its main actors GREEN STAR turned out to be a respectable practice example for cross-sectoral cooperation on green skills.

The obtained results give evidence to the basic European orientation and the GREEN STAR project approach. The GT VET training module was adapted (energy submodule), modified (waste submodule) and completed (LCA submodule) to fulfil the demands of the automotive supplier industry. Within this further development the transfer was conducted from a big company training module to SMEs and their regional clusters, from the steel industry to the automotive supplier industry, and from mechanical and electrical maintenance occupations to heterogeneous other professions. GREEN STAR showed on the one hand the necessity of the best available technologies for energy reduction, the importance of biodegradable materials but also on the other hand, that this has to go conjointly with a human resources improvement of green skills and the awareness of green production and behaviour. This embeds also the involvement

of the customers and their purchase decisions by improving their green awareness, as showed by the Action Plan of API.

Moreover, the application of the green content to the whole learning chain (school -apprenticeship – higher technical education – continuous training – company) was particularly relevant in Italy, where most of the content to enhance green skills where before simply not included in apprentices training programmes, nor in continuous training for small companies. The integration of these contents in the learning chain ensures anticipating future skills requirements and it also fosters cooperation among different stakeholders within the chain.

The use of GT VET approach, where different levels of content correspond to different levels of competences, was particularly also effective in each of the GREEN STAR Action Plans considered.

Finally, a very positive result is represented by the validation of the submodules content and approach also in clusters and industries not directly pertaining to the automotive suppliers, therefore it is opening the application of outcomes to a wider range of sectors.

Against this background the GREEN STAR experience fosters and underlines the following (mainly existing) policy recommendations:

- The relevance of cross-sector cooperation between big companies and SMEs
- The relevance of regional clusters and partnerships, within and beyond single industry sector clusters, not only in form of the so called Triple Helix (public authorities, companies, research institutions) but also by integrating the customers, civil society in a common social innovation process and eco-system
- The given possibility and added value of transfer of innovation processes (from GT VET to GREEN STAR)
- The need to combine technological improvement for greener production processes and products with human resources improvement of green skills
- The need to involve committed, concerned and capable stakeholders, coherently with the objectives, in order to achieve impact results. Therefore, not only direct target groups (e.g. companies) shall be implicated, but also stakeholders of the learning chain (schools, apprenticeship institutions)
- The relevance of the work-based learning approach to facilitate the transfer of knowledge immediately applicable to production processes.

Based on the results of GREEN STAR and the personal experience of the involved project partners the authors underline the necessity of funding for innovation development and transfer activities. Based on regional and cross-sectoral cooperation in Europe, embedding all the relevant regional actors and stakeholders, a European platform for exchange, research and development has to be provided.

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Appendix - Impact Evaluation Case Study

Alberto Vergani

FORM SUPPORTING THE IMPLEMENTATION OF SINGLE ACTION PLAN (AP) IMPACT STUDY USING THE CONTRIBUTION ANALYSIS (CA) MODEL[29]

Step 0
Basic information about company and Action Plan

- Company Name: *OMISSIS*. The company production process, this element is relevant for Action Plan (AP) contents, is carried out continuously for 24 hours on 24, 7 days a week, so energy flows involved in energy balance are relatively constant as well as the thermal and electricity flows. During the production process, the parts are heated and maintained at elevated temperatures in the oven (usually at 1120 °C) in accordance with technological requirements and then they are cooled until they reach ambient temperature.
- Company Address: *OMISSIS*
- Person/s interviewed (and role/function): *OMISSIS*
- Main AP contents (synthesis with a priority to expected final and medium-term outcomes on direct recipients and organisation): a) the training module about energy will be implemented; b) the AP implementation was carried out together with (and partly *after*) *a very* relevant investment in technology and process innovation for energy consumption reduction (in 2013-2014 with the 50% support of EC funding[30] and after a specific *energy audit*) and therefore the final company-level outcomes *come* from these three leverages (investment in technology, in processes innovation and training)[31]; c) the purpose of the AP is to improve the skills of participants regarding green knowledge, according to European experience after GT VET in the spirit of Green Star Project. In the same time, AP includes some concrete actions already implemented for reaching these goals which are organized in a

[29] The case, anonymous in this version, is an adaptation of one of the Action Plan impact evaluations carried out in the project. Due to editing and printing deadlines, this version is not the most updated but it is anyway fully explicative of the used methodology.

[30] The investment program implemented during 2013-2014 regarded "technological equipment. The main equipment consisted of: OMISSIS.

[31] Main activities implemented in OMISSIS in 2015 for reducing energy consumption are the following: OMISSIS.

reduction energy consumption plan in the company whose target is a 9% reduction a year; d) the final cost saving index is the "MWh consumption of electrical energy and gas" (difference from 8/2014 to 12/2015); e) employees involved in the training modules will become more experienced and skilled so as to be involved in an efficient technological process, to be active in optimizing the gas and electrical consumption and to be involved with new ideas to reduce waste energy. The final results deriving from Green Star Project participation (but also from the technological innovation introduced in the same period) will be a total reduction of energy consumption for the existing plan in the present, yearly the results for 201X, of XXX MWh which is estimated to be equivalent of EE.EEE Euros; f) employees to involve in training will be the following: *OMISSIS* (30 in total); g) the Action Plan budget is EEEE,EE Euros; h) the delivery of level 1 and 2 GT-VET module on energy will be from 8/2014 to 6/2015 while the delivery of level 3 and/or 4 modules (targeted to 13 employees) is scheduled from 1/2015 to 11/2015.

- Main elements emerging from *On-going AP Implementation Questionnaire* (filled in May 2015): a) AP implementation rate is at 60%; b) implementation level is "partially" in line with expected time schedule; c) AP "contents" implementation level is "partially satisfactory" as well as AP implementation consistency with expectations; d) AP implementation is rated as "difficult"; d) main **strengths** of AP implementation process are the following: the translation in Romanian of GT-VET training materials concerning energy; "the employees involved in level 1 and 2 modules easily understand them"; "the interest and involvement of the team who leads the project"; e) main **weaknesses** are the following: "the conditions for implementing levels 3 and 4 training contents for all the participants; the difficulties in attending training for participants working in two shifts; the measurement of the satisfaction for all the employees involved in AP"; f) the adaptation of GT-VET contents through the AP is rated as "partially satisfactory"; g) the AP is considered to "partially" respond to urgent and relevant company's needs; h) the 12/2015 AP expected impacts on directs training recipients are the following: understanding of importance of saving energy in a production company; the active involvement of trainees in new common actions aimed at reducing energy consumption; trainees awareness and knowledge of green skills and "of all the types of energy"; i) the 12/2015 expected changes in organization after AP full implementation: trained "press machine setters and electricians assumption of *leaders role* in saving energy" (70% due to AP implementation); "better understanding of sintering activity for oven-men because they can improve a lot the furnace load on square meter" (90% due to AP implementation); "involvement of the most important locksmiths in creating new ideas regarding energy saving processes" (70% due to AP implementation).

Step 1
Set out the cause-effect issue to be addressed

- Brief description of the company current situation (company's items, issues, areas, processes directly relevant for AP contents): actual *OMISSIS* situation is generally positive; the company is experiencing an interesting markets and products development (many potential customers, final products manufacturers companies, are approaching *OMISSIS*) such a development is strictly linked to technological, process and resources use improvements. Main *OMISSIS* competitors are located in *OMISSIS*.
- Level of compliance between programmed AP and implemented AP: total (29 participating employees in levels 1-2 modules instead of 30 indicated in the AP – but one student of XXXX Technical University "practicing in *OMISSIS* production Department" has been involved in training and in the next months other students will participate in internships and therefore in training).
- First *map* of AP strengths, limitations, threats: see what above indicated in presenting the company answers to the *On-going AP Implementation Questionnaire* (filled in May 2015).
- Definition of cause-effect question (with reference to the AP contents): *OMISSIS* uses in the manufacturing lines machineries and furnaces with huge energy consumption. For being in a future a competitive company, *OMISSIS* must continuously reduce energy costs. For this reason, the company has its own energy consumption reduction plan with important measures. Intervention on both technology and employees (mainly those with other people management responsibilities) skills and knowledge about energy saving is the core of strategy for reducing energy consumption.

Step 2
Develop the postulated TOC and risks to it, including alternative explanations

- Logic model (or result chain) depicting sequential actions from input (the AP as a whole) to results and what can be measured (see here below).

	Results chain	***TOC: assumptions and risks***
Long outcomes (final outcomes, impacts) /\	Further consolidation of energy consumption reduction by 9% a year; increase of efficiency in production processes and therefore of general company competitiveness; increase of company revenue-generation capacity	**Ass**: full coherence and synergy between trained employees behaviors and energy saving contribution deriving from new technologies and processes; trained employees long-term permanence in *OMISSIS*; existence of a direct relationship between efficiency in energy use, company competitiveness and company revenue-generation capacity **Risks**: relevance for company competitiveness and revenue-generation capacity (but also for energy consumption reduction) of variables/factors others that the energy-related ones
Medium/ intermediate outcomes /\	Consolidation of energy consumption reduction by 9% a year; training recipients active contribution in optimizing gas and electrical consumption; training recipients increase of activation and involvement in generating new ideas for reducing energy waste	**Ass**: existence of organisational conditions and individual motivations supporting trained employees pro-active and innovative behaviors in workplace; high compliance (and therefore synergy) between training contents, trained employees behaviors and energy saving technologies/processes implemented by *OMISSIS* **Risks**: influence on energy consumption levels of variables outside *OMISSIS* full control; inadequacy of organisational conditions necessary for supporting synergies between trained employees individual behaviors and energy saving-oriented new technologies and processes in *OMISSIS*

Short/immediate outcomes[32] /\	Energy consumption reduction of YYY MWh equivalent to EE.EEE Euros saving which is around 9% of 201X total energy cost; increase of training recipients skills and knowledge in energy saving and energy efficient use (with reference to *OMISSIS* production processes); training recipients direct involvement in the implementation of efficient technological and production processes (in *OMISSIS*)	**Ass**: existence of organisational conditions and individual motivations supporting trained employees learning achievements activation; high compliance between training contents, trained employees behaviors and energy saving technologies/processes implemented by *OMISSIS* **Risks**: inadequacy of organisational conditions necessary for supporting a positive synergy between training individual achievements and energy saving-oriented new technologies and processes in *OMISSIS*; training participants difficulties (for subjective and/or objective reasons) in transferring training learning achievements in workplaces
Outputs	Number of level 1-2 module trained employees; number of level 3-4 trained employees; number of training hours for each module level; level of satisfaction for training; self-perceived learning achievements	**Ass**: training participants are interested in training topics and aware of their importance both for *OMISSIS* competitiveness and their professional development **Risks**: difficulties in finding a balance between working duties and training participation; training participant insufficient involvement and/or understanding of topic's importance for *OMISSIS*

- AP Outputs: see the table here above.

- Map/list of individual/organizational and contexts issues that may affect AP outcomes: when these issues may be identified with *risks* see the table here above; other issues that may affect AP outcomes are the following: a) other companies competitions; b) the availability of more efficient and energy-saving technologies and/or process innovations that those implemented by *OMISSIS* since 2013; c) national and/or regional (local) policies (both by institutions and energy providers) concerning energy consumption, distribution and pricing/costs.

[32] Very Important: please note that since Level 3 and 4 training conclusion is scheduled by 11/2015 (see AP), the 12/2015 expected energy consumption reduction is considered as a short/immediate AP outcome.

- Map of the links between each action. AP consists in one action only and therefore it is *by itself* linked to the *outputs* and *outcomes* above indicated in the table. By this point of view, in AP design only one link exists between the AP itself and the "results chain" presented in the table. It may however be assumed that the AP is made of "different actions" which correspond to the *activities* described in the AP "Workplan" section (Translation of …..; training of …. ; and so on): on this subject, which particularly emphasizes the difference between module levels 1-2 and levels 3-4, the AP activities appear to be internally coherent and each other connected in a logical and linear way.

Step 3 (to be implemented simultaneously with Step 2)
Gather existing evidence on the TOC

- Identify all the relevant stakeholders directly involved in AP implementation and stakeholders who may influence outcomes. The company relevant stakeholders involved in the AP implementation are the following: the General Director; the Technical Director; the coordinators of company internal divisions; the GT-VET modules trainers (all internal, 3 units). As for the stakeholder who may "influence outcomes" they are both internal (*OMISSIS*) and external (the Government for energy pricing and policies through the National Authority for Energy; the public/private local energy suppliers).

- Gather the evidence available and assess the quality of evidence. Due to AP timing (remember than the level 3-4 training will be concluded in 11/2015), only evidences concerning AP implementation process (until 5/2015), AP outputs (although partial) and technical/process innovation introduced in *OMISSIS* since 2013 are available. As far as now, waiting for the first AP outcomes assessment to be held at the end of 2015, regular internal use partial energy reduction measures have been taken every three months and the first emerging evidences are positive. Following these positive *partial* outcomes, some additional efficiency-oriented interventions have been successfully implemented (e.g.: a cooling water system which uses recycled water has been introduced and it allowed to save money because the need for *new* water radically reduced).

- Start identifying gaps in the evidence. Due to what has just been highlighted (the training conclusion timing), main gaps in evidence regard the outcome levels represented by medium-intermediate and long-term outcomes (but more than *gaps* it's a matter of missing of any evidence, except for the provisional positive elements emerging from the quarterly checks carried out until now).

Step 4
Assemble and assess the contribution story and the challenges to it

Program assumption description 1*: due to GT-VET training module participation, OMISSIS employees (in their different company positions and responsibilities) develop specific learning (knowledge and skills) and personal attitude (awareness) towards energy, energy saving, renewable energies, energy efficiency, calculation of energy cost and effective use (with differences between 1, 2, 3 and 4 levels[33]).*

Mechanism (implemented)	***Alternative explanation (identified form data collection)***	***Influencing factors (identified from data collection)***	***Type of rival[34]***	***Degree of influence (Low, medium, high)***				
				Certainty [35]	*Robustness* [36]	*Range* [37]	*Prevalence* [38]	*Evidence-based/ evidence informed*[39]
Training module	The technical and process innovation	Trainees professional	Direct-non	High	Medium	Mediu m	Medium	Semi-structured

[33] Remember that level 4 training duration is 15 days, level 3 is 3 days while level 1-2 is 2 hours.
[34] Direct relevant, direct non-relevant, indirect relevant, indirect non-relevant.
[35] The degree to which the observed outcome matches the one predicted accounting for program assumptions and mechanisms (high, medium, low).
[36] The degree to which the assumption (or mechanism) is identified as a significant contributor to achieving program results.
[37] The degree to which the assumption (or mechanism) contributes to a broad range (e.g. impacts on one or more outcome) of outcomes.
[38] The degree to which the assumption (or mechanism) contributes to outcomes of interest across a wide range of implementation sites.
[39] The credibility and rigour of evidence which can verify or support findings from the analysis (Low=untested local studies; Medium=case studies; High=Experimental/quasi experimental studies).

participation (with a different duration for levels 1-2 and levels 3-4 trainees) develops recipients specific learning and awareness toward energy saving issues and applications	introduced since 2013 for energy-saving purposes developed in training recipients energy saving skills and awareness; the training recipients professional backgrounds already include energy-saving and efficiency skills and competencies	and personal interest for module topics; training module levels 1-2 duration (very short) versus levels 3-4 (much longer); training recipients direct involvement in new energy-saving technologies/processes	relevant					interviews, documents analysis

Program assumption description 2*: due to learning and personal attitudes (awareness) developed though GT-VET module, OMISSIS trained employees (especially those who attended all the module levels and are more directly experienced and involved in energy-related issues) become more actively engaged in professional behaviours aimed at increasing energy use efficiency (also assuming the role of leaders in energy saving actions and proposing new ideas for the implementation of energy saving processes) and are able to better enhance the energy saving contribution of the new technologies and process innovation introduced in OMISSIS since 2013*

Mechanism (implemented) [40]	***Alternative explanation (identified form data collection)***	***Influencing factors (identified from data collection)***	***Type of rival***	***Degree of influence (Low, medium, high)***				
				Certainty	*Robustness*	*Range*	*Prevalence*	*Evidence-based/ evidence informed*
After training participation employees (especially those involved in levels 3-4 modules) implemented individual working behaviours aimed at increasing energy use efficiency and at maximizing the energy saving contribution by new	The technology and process innovation introduced since 2013 *produce* energy-saving effects whose entity do not (or very marginally) depend on workers/ employees skills and attitudes	Trained employees motivation and engagement in company strategies; organisational conditions supporting individual activations and responsibility assumption; company policies and practices supporting individual activation; trained	Direct relevant	Medium	Medium-low	Medium	Low	Semi-structured interviews document s analysis

[40] Only levels 1-2 training are concluded (6/2015) while, as already underlined, levels 3-4 training is actually under implementation.

technologies and processes implemented since 2013		employees real possibility to have an influence on energy-saving related processes and decisions						

***Program assumption description 3**: the energy-saving and energy efficient-use trained employees behaviours in combination with the huge energy saving-oriented technological and process innovations introduced in OMISSIS since 2013 lead to a company energy consumption average yearly reduction by 9% from 201x on (the expected reduction for 2015 is estimated in XXX MWh which is the equivalent of EE.EEE Euros that is around 9% of 201X total energy cost)*

Mechanism (implemented)	***Alternative explanation (identified form data collection)***	***Influencing factors (identified from data collection)***	***Type of rival***	***Degree of influence (Low, medium, high)***				
				Certainty	*Robustness*	*Range*	*Prevalence*	*Evidence-based/ evidence informed*
Being the end of 2015 the first deadline for this program assumption no related mechanism has been implemented	The 9% reduction may be originated (totally or partially) by factors different from both AP and technology/process innovation; the 9% reduction may	Market/clients conditions, trends and policies; public policies concerning energy-saving; unexpected changes in	Direct relevant	Not possible to answer at the moment	Not possible to answer at the moment	Not possible to answer at the moment	Not possible to answer at the moment	Semi-structured interviews document s analysis

until now	be originated by technology/process innovation only; the 9% reduction may be caused by a diminution in total production volume or in plants utilization	products; increase in cost of energy (due to variables outside *OMISSIS* control)						

- Start shaping the *contribution story*. Considering what exposed in the tables here above, the AP contribution in achieving the *expected outcomes* may be considered as summarized in the table here below.

Short-immediate outcomes[41]	*Medium/ intermediate outcomes*	*Long-term/ Final outcomes*	*Notes*
Achievement: 3 AP contribution: 100%	Achievement: too early for this type of outcome AP contribution: not identifiable at the moment	Achievement: too early for this type of outcome AP contribution: not identifiable at the moment	Training module level 1-2 delivered by 6/2015; level 3-4 delivering to be concluded by 11/2015

- Assess the strengths and weaknesses of the intervening steps in the program logic accounting for other influencing factors not previously identified. The list of "influencing factors" indicated in the tables above seems to be quite complete and contains elements whose relevance in *conditioning* AP outcomes achievements must be taken in serious account. The constant interrelation between module results and technology/processes innovations in producing the expected long-term outcomes (absolutely evident for the last *program assumption*) causes influencing factors to cover both individual and organizational issues, very frequently each other connected and – in addition – reciprocally influencing.

[41] End of 2015.

Step 5
Seek out additional evidence

- Use secondary data to confirm or refute expert knowledge or judgments. Considering the (largely potential) clear and documented relationship between the AP and its outcomes, no *secondary data* to confirm or refuse Step 4 conclusions has been considered as needed.

Step 6
Revise and strengthen the contribution story

- Reassess program strengths and weaknesses through continuous improvement process (one more round of Step 4 in this case). Assuming both the existing deadline for this evaluation and the 11/2015 as training module delivery conclusion (for levels 3 and 4), no additional operation of "reassessment" of AP strengths and weaknesses has been carried out.

Final notes

Methods used for implementing the impact study (techniques and stakeholders involved): company produced documents analysis; interview with OMISSIS Technical Director.

Additional free comments: XXXXXXXX.

Form compiled by: XXXXXX.

Compilation date: XXXXXXX.

(end)

Green Skills along the Value Chain of the Automotive Suppliers Industry

"Green Skills" are seen as a relevant qualification for the European industry, not only for the sake of the environment but also as a competitive advantage. Against this background the GREEN STAR project transferred the "GT VET - Greening Technical Vocational Education and Training" blueprint (a steel industry driven sustainable European training module) to the automotive suppliers industry. Two submodules of GT VET were adapted ("Energy") or modified (Waste"), and an additional submodule ("Life-Cycle Assessment") then completed the GREEN STAR training module. The transfer of innovation from a big company training module to SMEs and their regional clusters, from the steel industry to the automotive supplier industry, and from mechanical and electrical maintenance profiles to heterogeneous professions was thus conducted.
GREEN STAR shows on the one hand the necessity of the best available technologies for energy reduction, the importance of reusable and biodegradable materials, and on the other hand how this has to go conjointly with an improvement of green skills and the awareness of green production and behaviour. It also embeds the involvement of the customers and their purchase decisions by improving their green awareness as well as the application of the green content to the whole learning chain (school - apprenticeship - higher technical education - continuous training - company). Based on the results of GREEN STAR and the experience of the project partners, the authors underline the necessity of funding for innovation development, for regional and cross-sectoral cooperation in Europe, embedding all the relevant actors and stakeholders, establishing a European platform for exchange, research and development.

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