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Scaling up Resource Efficiency and Cleaner Production for an sustainable industrial development

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Abstract

Resource Efficiency and Cleaner Production (RECP) is a globally proven approach to improve productivity and reduce environmental impact of the enterprises. Application of RECP is beneficial for enterprises, in particular SME's, contributing to enhancing their *productivity* and competitiveness; for the *environment* by lowering the impact of their operations, and for *people*, by decreasing the risks to workers and communities (UNIDO, 2015).

Greening up the economies, the major global trend nowadays, could become reality by focusing on the existing industries and by supporting an significant number of enterprises, in particular SME's, to increase resource efficiency and productivity while lowering their impact on the environment. Implementing RECP requires a systematic and continuous approach for the identification and evaluation of the existing inefficiencies, addressing them by applying "standard practices" to all waste and emissions causes and process inefficiencies and monitoring the enterprises level results; the method usually implies elaboration of quit complex materials and energy balances, and laborious feasibility analyses, activities usually performed with technical support from RECP experts. The question raised in the last years was how to increase the number of companies implementing RECP and how to sustain and mainstream RECP. Solutions are proposed to intensify application of RECP methods, practices and techniques and innovative approaches are used to facilitate the expansion of RECP application and transfer of existing experiences and best practices to a larger number of enterprises.

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1. Scaling up Resource Efficiency and Cleaner Production for a Sustainable industrial development

The paper intends to an restricted review of the literature on “scale up”, to discuss the “scaling up” concept of resource efficiency and cleaner production (RECP) for more sustainable development of industry, to assess the need for scaling up application of RECP, in particular in small and medium enterprises and to evaluate similar existing models worldwide and their relevance for resource efficiency, productivity and for the reduction of pollution intensity at the industry level.

1.1. About Resource Efficiency and Cleaner Production and its application

The Cleaner Production concept has been firstly defined by UNEP in 1994 as the “continuous application of an integrated preventative environmental strategy to processes, products and services to increase efficiency and reduce risks to humans and the environment” (UNEP, 1994). Since its conceptualisation, cleaner production has been applied in 72 countries around the globe, using the experience of industrialized countries and their commitment of providing developing and transition countries with methods, practices and techniques for more sustainable production, by building national structures - the national cleaner production centres, and technical capacities – the national experts, in order to ensure further scaling up and replication of cleaner production applications.

Based on the experiences gained through the years, the Cleaner Production concept has been developed, expanded and redefined as the “Resource Efficiency and Cleaner Production”; the new definition makes the logical connection between the productive use to resources, reduction of waste and emissions and the enterprises’ productivity and competitiveness and refers as “the continuous application of preventive environmental strategies to processes, products and services to increase efficiency and reduce risks to humans and the environment, addressing all three sustainability dimensions individually and synergistically” (VAN Berkel, 2015):

- production efficiency through productive use of natural resources in all production stages
- environmental management through minimization of the adverse impact of the industrial activities on nature and the environment
- human development through minimization of risks to people and communities

The joint UNIDO&UNEP Programme on Resource Efficiency and Cleaner Production, aiming to improve resource efficiency and environmental performance of businesses in developing and transition countries, provided for the first time a strategic and coherent approach for mainstreaming and upscaling activities and results of national cleaner production centres, nationally, regionally and globally[†]. As a result of 17 years intensive work undertaken by the national cleaner production centres (NCPC’s) around the world, thousands of companies have benefited from the adoption of sustainable solutions, which contributed to improve their resource efficiency, increase their productivity and at the same time, decreasing their environmental impact.

RECP solutions are typically identified and assessed during intensive and time consuming in depth plant assessments, often requiring advanced expert knowledge and massive technical support to applicant companies. However, in order to ensure transition to more sustainable production systems, application and adoption of RECP methods, practices and techniques, those should be mainstreamed, scaled up and expanded beyond the in depth assessments and have higher impact on more companies, while investing less time and efforts. This could be achieved by *replicating* of well-known solutions and best practices within the same target group, sector or cluster, *streamlining* or eliminating steps that may not be necessary to achieve similar result, *expanding* or seeking new applications and markets for practices proven elsewhere and *innovating*, by finding new solutions that have more substantive benefits.

In UNIDO’s view, *scaling up* is best understood as a “significant reduction of the effort required per company to implement RECP”, meaning greater efficiency and effectiveness in RECP assessment and implementation, or “making RECP easier for enterprises”, whereas *mainstreaming* is best understood as embedding drivers and

[†] Joint UNIDO-UNEP RECP Programme: General overview

incentives for RECP implementation meaning stronger incentives for RECP consideration and its continued implementation, or “incentivizing enterprises for RECP”. Conceptually, mainstreaming and up-scaling are complementary approaches to achieve the policy goal of achieving transformative increases in the numbers of enterprises committing to RECP and in the scale of economic and environmental benefits they individually and collectively achieve through implementation of RECP methods and techniques (Van Berkel, 2015).

1.2. Methodology

The applied methodology included the literature review based on internet search of relevant papers and case studies from various sectors such as: environment, health, agriculture and natural resource management, the review of experiences gained by scaling up projects of eco-efficiency practices in industry, participation in two workshops, project based, organised by UNIDO for the key representatives of countries that took part in the programme, and the assessment of the results obtained during RECP Clubs, a model applied for scaling up RECP in Moldova.

1.3. Different approaches on scaling up

The section is intended to discuss various approaches on scaling up concept as identified during the literature review. The concept of scaling up has been referred to in various literature sources; the definition provided for the concept depends very much on the model, strategy, method used or innovation to be scaled up, thus contributing to more confusion due to “little agreement on definitions of models, and relatively few well documented case studies”. The term is used in different contexts and sectors (e.g., education, health, social studies, and environment), although an internationally accepted definition is not yet available. However, the general understanding of “scaling up” term is “using existing small scale projects as a basis for achieving large scale changing.

According to different literature sources, the term of “scaling up” is used in connection to replication, adaptation, and spread of techniques, innovations, approaches or concepts and increase the scale of impact. Scaling up could be achieved in either of two basic ways: expansion of experience and transferring of experience through a universalist (universal generalizations that could be applied using a simple set of rules) or contextualist approach (practices to be scaled are tailored made and address specific context conditions).

The two approaches are represented in the Figure 1.

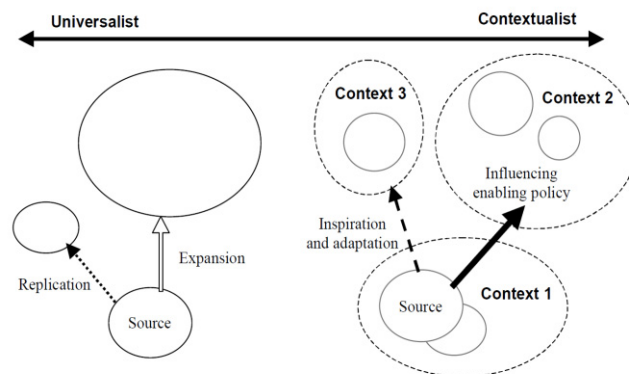


Figure 1 Universalist versus contextualist approaches for scaling up

Source for Figure 1: Jim Hancock, World Bank consultant

According to Blackburn (Blackburn, 2000) a typology that could be applied to characterise any scaling up strategy, typically refers to:

- the model, innovation or project to be scaled up – what is being scaled up;

- the methods of going to scale – the how of scaling up;
- the organizational roles involved in scaling up – the who of scaling up;
- the dimension(s) along which scaling up occurs – the “where” of scaling up

This typology has been further analysed by Richard Kohl and Lawrence Cooley in their report (Scaling Up – A Conceptual and Operational Framework, 2004) and the following main ideas could be extracted for each of the key elements:

The key components of the **model** refers to: types of projects, documentation and simplification of the model, organisational and social context and viability of the model. Four types of projects could be considered for scaling up: pilot projects, demonstration projects, capacity building projects and campaigns; in all these examples, the initial project is intend to identify new and successful solutions that could be adopted by others and take the first step to scale up. Before being taken to scale, the model has to be well documented and its effectiveness has to be assessed. Success of scaling up models are influenced by the institutional characteristics (culture and value, principles, management style, staff skills, etc.) while the political and social context (economic conditions, cultural) could affect the project success. The proposed scale up model shall be compared with the existing alternatives in order to assess its viability in terms of impact and cost effectiveness, in this case building up an ongoing method for monitoring, measuring, evaluating and publicising can be particularly useful in selecting the models.

The **method** – an of the most useful discussion in the literature belongs to David Korten's, its classic depiction of the process in terms of three stages refers to: effectiveness (developing a solution that works), efficiency (finding a way to deliver the solution at an affordable cost), and expansion (developing a way to provide the solution on a larger scale) (Korten & Siy, 1998). The framework proposed by Blackburn and used by Richard Kohl and Lawrence Cooley in their report, is proposing a typology of three types for scaling: *expansion*, *replication* and *collaboration*. The three types are distinguished by the degree to which the originating organization continues to control implementation as the model goes to scale.

Expansion refers to increasing the scale of operations of the originating organization and could refer to pilot and demonstrations projects;

Replication is oriented to increasing the use of a specific model (techniques or technology, particular process or service) by more organizations

Collaboration is a method required for making possible expansion and replication ((Blackburn, James, Chambers & Gaventa, 2000)

Other authors are referring to the need of identification of appropriate strategies to accelerate uptake of innovations by organisations and to provide a framework to guide the formulation of scaling-up mechanisms for innovations towards the aim of increasing resource efficiency and reducing the environmental impact. Two main typologies which cover the process of dissemination and uptake on the one hand and the multiple-stakeholder involvement and institutional processes on the other, are mentioned. Vertical scaling-up is institutional in nature and involves other sectors/stakeholder groups – from grassroots organizations to policy-makers, donors, development institutions and international investors while horizontal scaling-up is the geographical spread and expansion to more people and communities within the same sector or stakeholder group (Gündel & Hancock, 2001). According to Gündel and Hancock the typology of scaling-up identifies four types: *quantitative scaling-up* refers to an increased number of organisation or people involved through replication of activities, *functional scaling up* referring to expended types of activities within same programmes, *political scaling-up* meaning project are moving beyond delivery of services towards institutional changes and *organisational scale up* allowing increasing efficiency and effectiveness of organisations and sustainability of interventions.

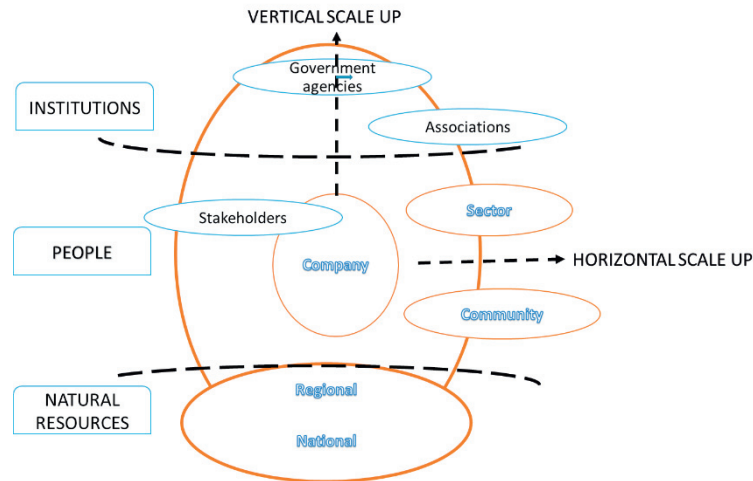


Figure 2 The typology of scaling up

The lessons learned by Gündel and Hancock after reviewing the literature and a selection of case studies on “scaling up” from several sectors is that there are no simple rules for scaling up and the existing strategies need to be addressed more extensively from both perspectives : research and implementation in various sectors. The research contributions shall concentrate on three main directions: (1) how to monitor and evaluate different scaling up approaches and determine their cost effectiveness, (2) how to develop partnerships and mechanisms for policy dialogues and communication with target groups and (3) how to learn from other sectors experiences. There is a general need for clear and credible documentation of models to be scaled up, for demonstrating their relevance, efficiency and effectiveness. Specific resources, skills and motivation are needed to perform the scaling up functions and simplified models (without losing their effectiveness) are more feasible to scale it up (Blackburn, James, Chambers & Gaventa, 2000).

The model used to describe the “scaling up” in a sustainable industrial development is a combination of different processes that could have individual definitions by themselves. This model includes terms such as: *replication*, *streamlining*, *expansion* and *innovation*.

For example, the strategy for scaling up RECP application is represented in the Picture 2. The picture clearly depicts the main elements of the scaling up strategy and the objectives to be achieved: impacting more companies, using less efforts and having a greater impact per company.

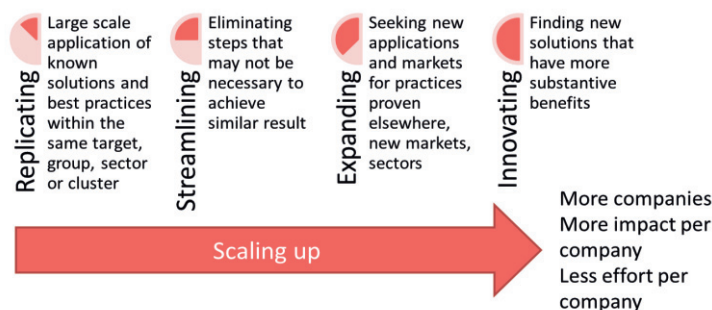


Figure 3 Scaling up model in a sustainable industrial development

The table below provides a brief description and clarification of these terms, including their underlying principles, application areas, and thrust (Van Berkel, 2011).

Table 1. Scaling Up Disentangled

Terminology		Description	Application Areas	Thrust
Scaling up	Replicating	Large application of known solutions and best practices (widening)	Within same target group, sector or cluster	Using best practices - business development
	Streamlining	Eliminating steps that may not be necessary to achieve similar results	Within the same target group, sector or cluster	Doing it effectively and efficiently
	Expanding	Seeking new applications and markets for practices proven elsewhere	New sectors, countries, clusters, etc.	Making it applicable in different areas
	Innovating	Finding new solutions that have more substantive benefits (deepening)	All areas	Continuous development and improvement

Source: Rene Van Berkel, 2011, UNIDO-UNEP Resource Efficient and Cleaner Production (RECP) Programme.

1.4. The relevance of scaling up for an sustainable industrial development

The intense use of materials, energy and water, under the auspicious of the global economy growth, has serious implication on the extraction rates and scarcity of natural resources, environmental pollution (air, water, and soil), climate change and human health. All these impacts are recognised as stringent global challenges. Furthermore, under the market pressure the prices of raw materials, energy and other goods are raising continuously, affecting directly the businesses and their capacity to supply with raw materials in time and at affordable prices, increasing their business risks and impacting their profitability and competitiveness.

Amongst the businesses, SME's are most vulnerable to the global challenges, these are accounting for a large part of the world's consumption of resources and generation of waste and emissions. While pollution created by individual SMEs is lower, the overall the impact on the environment is high due to their large number; The existing data shows that SMEs have the tendency of underestimating their environmental impact, do not associate the environmental impact with production inefficiency, and the saying "what is not measured cannot be managed" is particularly true in case of SMEs (UNEP, 2003). SME are small businesses and have more difficulties in accounting environmental responsibility; failure to comply with environmental legislation, little knowledge of environmental management, less technical knowhow, or lack of modern technology, are just few of the challenges confronting them. In this regard, the adoption of more sustainable solutions has become imperative for businesses to survive; there is a stringent need for increasing the number of enterprises committing to resource efficiency and to scale up economic and environmental benefits through implementation of RECP methods, techniques and practices.

Traditionally, RECP methodology is applied in a systematic manner, following successive steps for achieving optimal solutions, tailored to the company's operations and management and organizational culture. The systematic application RECP is currently known as the RECP in depth assessment. Depending on the complexity and size of the company, in depth RECP assessments could be time demanding and could require high technical expertise and sectoral specific knowledge. However, the existing experience has shown that in many cases in depth assessments carried on with experts are not always necessary and the expert assessment does not necessarily increase the enterprise capacity to implement RECP. Scaling up RECP practices and could be rapidly achieved through the expansion of the RECP delivery beyond the in depth assessments by developing a simplified model to be transferred to a group of enterprises. Training and coaching companies to understand the issues, guiding them to perform a systematic root source and cause analysis of the identified issues and supporting them to identify, evaluate and implement RECP opportunities, could be more effective on long term. Such models help creating the necessary expertise within the enterprises for continuing the systematic application of RECP and the ownership over the improvement process, facilitate the adoption of RECP into day to day operations, changing the mind-set of employees and enhancing innovation and creativity in the company.

1.5. Existing scale up models of eco-efficiency practices

The collective consulting approach is based on 20 years of international experiences and has been implemented in different forms. Examples of such programs in Europe are: Miljøfyrtårn – “environmental lighthouse” in Norway, The Natural Step in Sweden, Envirowise in the UK, Green Network in Denmark, Bretagne Environment Plus in France, environmental pacts and alliances in nearly all German regions (Bundesländer) as well as the consulting program “Ökoprofit”, initiated in Austria and diffused worldwide (Martinuzzi, 2006). Similar approaches are used in India, the Waste minimization Circle, collective consulting initiative sponsored by the Ministry of Environment & Forest, Waste minimization clubs in South Africa (a group of businesses that have agreed to minimize waste in exchange for a lower waste disposal tariffs) and others.

Probably the most notorious program for preventive environmental management and sustainable development of companies and communities is ECOPROFIT®. The ECOPROFIT® model was developed 15 years ago in Graz, and successfully implemented in Graz as well as nationally and internationally. There are more than 5000 enterprises in countries such as: Austria, Germany, Slovenia, Italy, Korea, China, Colombia connected through the ECOPROFIT® Clubs. In principle, the ECOPROFIT® Club Program is a network in which different companies from industry, tourism, as well as large companies and micro companies work together on their sustainable development. The companies receive specific input in workshops and the support they need to implement new technologies in their companies with individual consulting. The participating companies, consultants, authorities and research institutes have the opportunity for constructive networking and to benefit from various effects of synergy. The key elements of the program are joint workshops, individual consulting and final award. The results of the program were very encouraging, after 10 years of implementation important reduction in resource use and waste generation have been achieved (14.4 million liters of power fuels; 64.6 million m³ of natural gas; 222,600 MWh of electricity; 9.28 million m³ of water; 21,000 tons of residual waste and 403,150 tons of CO₂-emissions) (Kern & Fresner, 2009) .

The RECP Club, recently proposed by UNIDO, is a scaling up model that works well for a variety of SME's situated in the same region, from industry and service sectors. The principal idea of the RECP Club is to bring together 8 to 10 small businesses from the same region and guide them jointly through an intensive training and coaching program over a period of 4 to 6 months, leading to a customized RECP action plan for all member companies, on completion of the coaching round. This model has been applied within the Partnership for Environment and Growth (EaP GREEN) in six participating countries (Van Berkel, 2015). The Project supports the governments of Armenia, Azerbaijan, Belarus, Georgia, Moldova and Ukraine to start the transformation to a green economy and thereby decouple economic growth from resource depletion and environmental degradation.

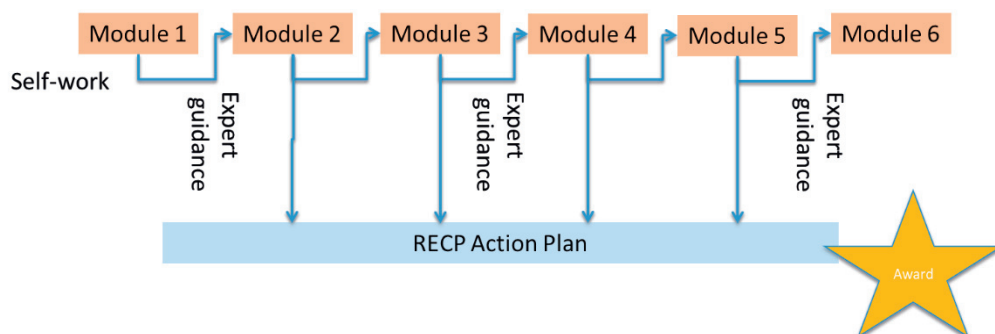


Figure 4: The RECP Club Model, Source: Concept note RECP Clubs EaP GREEN, Rene van Berkel, 2015

The new RECP Club model consist of six thematic modules focused on:

1. Business Profile: profiling of the enterprise with a particular focus on identifying resource uses and environmental impacts and appraising these in both physical units (tons, kWhr) as well as their monetary value (input costs and non-product output costs);;

2. Energy: understanding energy use in company and developing energy efficiency options for processes, utility systems and buildings management;
3. Materials and Waste: understanding main material flows in enterprise and associated waste streams, and developing materials efficiency and waste reduction options;
4. Water and Waste Water: understanding main water flows in enterprise and associated waste water streams and developing water efficiency and effluent reduction options;
5. Chemicals, Hazardous Waste and Emissions: understanding chemicals use and associated hazards and emissions, and developing options for sound and responsible chemicals use; and
6. Action Planning: bringing together options from different topics into an integrated approach for enterprise with short, medium and longer term goals and actions.

Each thematic module describes: “The WHAT”– the global and national concerns as well as concerns at the business level related to resource consumption (materials, water and energy) and generation of waste and emissions; “The WHY” – the challenges for businesses in terms of cost, risks and impact on the environment, the benefits out of RECP implementation and local business examples; “The HOW” – the RECP method applied for understanding the issues in the company, performing a systematic root source and root cause analysis and identifying, evaluating and implementing RECP options for each thematic area.

Prior EaP GREEN, the first RECP Clubs have been established in Moldova in 2014, as a component of the RECP regional replication program for industry, within the National Cleaner Production Program of Moldova with support from UNIDO. During the first round, three parallel RECP Clubs were run in three different regions; 7 to 10 companies from each region participated in monthly workshops, during which, subsequent topics of RECP method, techniques and practices have been covered and hands on assistance provided for implementation in participating companies. In between the workshops, the national experts, provided company specific guidance on implementation of the respective topics, performed 2 to 4 technical visits in each company, coached them at distance, gathered and evaluated their data and made recommendation for implementation of RECP measures. Several RECP Clubs rounds in different regions attracted 102 companies in total, contributing further to scale up and replication of the RECP methods, techniques and practices and to identification of some hundreds of RECP measures that enabled important reduction of resource use (418 MW electricity, 35.000 m3 of water, 118 tones materials), economic benefits (257K USD) and the coagulation of the regional initiatives. The pilot round clearly demonstrated the scalability and replicability of RECP in SMEs through the RECP Club model, allowing the exponential growth of the companies that benefited of RECP services, from 17 in depth RECP assessments to 102 simplified RECP assessments and enabling the identification and application of hundreds of eco-efficiency measures including relevant ecological and financial benefits. The model has been proved to be scale-able and replicable, in that after initial trials in three regions was made available to 28 more companies in the same region and to 48 more companies in two more regions.

Based on the lessons learned in Moldova, the scale up model has been improved and its application standardized through elaboration of a dedicated resource package (manual, presentation, self-assessment tool, worksheets) and has been expanded within the EaP Green Program to five more countries (Armenia, Armenia, Azerbaijan, Belarus, Georgia). The RECP Club work stream under EaP GREEN was aimed at developing and piloting a lean support model for enterprises, in particular smaller businesses. Two pilot rounds have been applied successfully in the five countries and 4 RECP Clubs have been established in 4 different regions of each participating country. Each RECP club gathered minimum 8 companies from different sectors. The obtained results are still aggregated and will be soon presented the EaP GREEN project management and coordination.

2. Conclusions and findings

The first pilot project implemented in Moldova clearly demonstrated the scalability and replicability of RECP in SMEs through the RECP Club model, allowing the exponential growth of the companies that benefited of RECP services, from 17 in depth RECP assessments to 102 simplified RECP assessments, enabling adoption of eco-efficient solutions, a relevant improvement of resources use and reduction of environmental impact. Undoubtedly,

the pilots developed in the Armenia, Armenia, Azerbaijan, Belarus, Georgia within the EaP GREEN program will demonstrate the relevance of the RECP Club and the aggregate data to be published soon will demonstrated this.

Scale up models could address group of enterprises gathered in a club, cluster, value chain or industrial park. Such programs work best if implemented with support from public authorities or even sponsored through available financed programs (e.g., EKOPROFIT® financed by the Austrian Development Agency in many countries).

As previous experiences showed, scale up models for expanding and replicating eco-efficiency practices and sustainable solution including resource efficiency and cleaner production, have a long term impact in the companies and could contribute to build in house capacity and increase commitment towards sustainable production practices. Moreover, the joint workshops are an excellent opportunity for developing networks, exchange knowledge and experiences and increase business cooperation Scale up models could address group of enterprises gathered in a club, cluster, value chain or industrial park. Such programs work best if implemented with support from public authorities or even sponsored through available financed programs (e.g., EKOPROFIT® financed by the Austrian Development Agency in many countries).

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