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THE SELECTION OF INDICATORS FOR THE EVALUATION OF PROGRAMMES OF REGIONAL ASSISTANCE IN THE EUROPEAN UNION

Final Study

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Abstract

The objective of the present study is the improvement of the planning system, the selection of projects and the assesment of the impacts of regional programmes, and particularly concerns the re-definitions of the sets of indicators in use, in order to ensure:

- that intervnations funded by Stractural Funds are in line with the main EU policies end espesialy those on; and
- better exploitation of the opportunities and to confront more effectivily with the threats of technology.

Technological content of regional interventions and their links with EU policies on suatainable development and environmnet, employment and equal opportunities were analysed based on a number of regional programmes. The analysis resulted in a taxonomy of actions with technological content which formulate the basis for the clasification of indicators.

Further the impact of technology on sustainable development, employment and equal opportunities was analysed and sets of baseline and technology impact indicators were developed.

Finally a methodology framework was developed which allows EU policies on sustainable development and quality of the environment, employment and promotion of equal opportunities to be taken into consideration during planning and evaluation of interventions and selection of projects. The framework also allows the assessment of the use of technology to be introduced as an integrate part of impact evaluation and project selection.

Executive Summary

Policy interventions within the scope of regional economies have been increasingly relying on the assumption that at the core of the economic processes lies technical change and innovation. Sustained competitive advantage is based on the technological and innovative potential developed within the regional economic and institutional milieu.

Therefore policy makers, both in regions and in European Commission. should take into consideration the potential opportunities and threats of technology during the planning. implementation. and final assessment of the interventions supported by Structural Funds and the Cohesion Fund.

The objective of the present study is the improvement of the planning system. the selection of projects and the assesment of the impacts of regional programmes in order to ensure:

- that intervantions funded by Stractural Funds are in line with the main EU policies end especial? those on sustainable development and environmnet. employment and equal opportunities: and
- better exploitation of the opportunities and to confront more effectively with the threats of technolog!..

Technological content of regional interventions and their links with main EU policies

Analysis of a number of Single Programming Documents and Operational Programmes of Objective 1, 2, 5b and 6 regions shows that technology plays significant role on the achievement of the sustainable development and environmental objectives of EU policy. Areas of intervention where technolog!, has significant effects are the energy sector. transport. protection of the environment, agriculture, forestn,, fishery. rural development and R&D and innovation. Also applications and services under the framework of information society were found to support these goals.

Accordingly. technology seems to contribute to the employment policy directly in intenentions in the area of human resources. rural development. environmental protection. agriculture and forestn. and indirectly in the area of transport. energ!.. information society. R&D and innocation and fisher!..

The role of technology in the promotion of equal opportunities is restricted. Mainly "soft actions" targeting the development of human resources are the major means for the promotion of equal opportunities. Interventions aiming at rural and urban development are usually funding applications of information and communication technologies have also as objective the promotion of equal opportunities.

Impacts of technologies and their links with main EU policies

Technology used in actions funded by Structural Funds has different levels of environmental impacts. The direct or indirect effects. as well as the negative or positive results on the environmental conditions, depend on the nature of projects/actions and the objectives they target for. The analysis of the environmental impacts of technology presented in the study is based on the classification of actions with technological content.

The impact of technolog!. on employment is the net result of

- job losses due to direct labour-displacing effect of technolog!. transfer and innovation and to the decline of particular sectors; and

- job gains (jobs created or safeguarded) due to employment-creation effect of technological change (technology transfer and technological innovation) and the growth of sectors influenced by the transformations of the educational and training systems and the adjustment of the labour and financial markets:
- employment generated as an indirect consequence of the intervention (i.e. increase of the demand for goods and services produced in other sectors or improve of the efficiency in the local economy);
- employment generated during the implementation of an intervention (e.g. during the construction phase of a new power plant. the extension of transport networks or during the implementation of training courses):
- employment generated due to income multiplier effects (i.e. employment generated in response to increased demand due to income rise resulting from the intervention).

Contrary to the environment and employment. technology's effects on equal opportunities seems to be not so straightforward. In the study four areas of impacts were identified and esamined namely:

- living conditions which meet nomen's needs
- access to the job market
- work conditions
- participation by women in the creation of socio-economic activities

Indicators for evaluation

Indicators provide quantified information in order to help identify and explain changes over time in relation to the objectives at each programming level as they are defined by the intervention logic of the Operational Programmes and Single Programming Documents. To be able to estimate the effectiveness of a programme, a set of indicators is necessan. usually including Input. Output. Result and Impact indicators.

The study focuses on indicators that can be used for the evaluation of impact of actions with technological content on sustainable development and environment, employment and equal opportunities.

Therefore. a review of the indicators used so far is presented and sets of indicators are proposed as suitable for the estimation of impact of: R&D: innovation and technology transfer in business: information society: agriculture and forestry; fishery; rural development; energy supply and production; transport; and infrastructure for environmental protection, on sustainable development and environment, employment and equal opportunities.

Conclusions regarding strategy on evaluation and selection of projects.

There is a recognised need that sustainable development and quality of the environment. safeguarding or creation of new jobs and promotion of equal opportunities should be taken into consideration during the planning and evaluation of interventions and selection of projects.

Further to Commission's recommendations and the practices of the Member States. an assessment of the exploitation of technolog!. should be additional introduced as an integrated

part of the impact evaluation. As already argued, the use of technolog!. can support or undermine the efforts for sustainable development, increase of employment and equal opportunities. Therefore, it is crucial to assess the mode technology is incorporated into regional interventions as well as the espected impact.

The creation of an intervention of regional assistance is a process where decisions taken in early stages affect profoundly the latter ones. Hence, the decisions on the objectives and general content of measures taken during the drafting of Operational Programmes and Single Programming Documents, affect the criteria used for project decided at later stages. Therefore, it is important that all the potential impacts are identified early in the process of the Regional Development Plan preparation and the ex-ante evaluation of the individual Operational Programmes and Single Programming Documents.

The evaluation of the conformity of projects with the EU policies on employment, sustainable development and equal opportunities can be carried out effectively only if the general objectives of the intervention. as well as those of the measures at lower levels. are quantified and specific indicators to signal the progress towards the achievement of the objective are set.

The impact indicators for the evaluation of interventions proposed within this stud!.. should be used as a minimum set and should be further enhanced in order to fulfil all the requirements of specific interventions under question.

At this point the definition of a set of baseline indicators establishing the status of regions before the intervention is also crucial. This set should be compatible with the indicators used for expressing the targets and those used for the evaluation of results and impacts.

Lack of, or inadequate baseline indicators and lack of quantified targets will negatively affect the quality of any assessment. The baseline indicators proposed in the present study could be used as a starting point. It should be pointed out that it is impossible to foreseen all type of possible interventions that could be supported by Structural Funds in order to include relevant baseline indicators beforehand. Therefore. when specific Operational Programmes or Single Programming Documents are being planned. the proposed lists of indicators should be adapted to the particular objectives and particularities of the intervention under question.

Regional authorities do not always meet effectively the above issues (i.e. the quantification of objectives and the creation of baseline and impact indicators) during the planning of an intervention. due to the complexity of the structuring effects of intenentions. the lack of experience and the absence of a reliable set of statistical data. This is especially true for environmental data where the following problems has been identified: scientific uncertainties and lack of knowledge; lack of precision in measuring the impact: low qualit! of existed environmental statistics: in some cases geographical areas affected by interventions are not compatible with the division followed by environmental statistics.

The procedures applied for the selection of projects is also crucial. especially for the fulfilment of the objectives of sustainable development and protection of the environment. An effective selection procedure should ensure that:

- selected projects satisfi the objectives of the interventions supported by Structural Funds:
- selected projects are in line with the major objectives of EU policies and especially those related to the employment, sustainable development and equal opportunities
- benefits are maximised within the framework of existing options

Therefore, such a procedure should include:

- a set of reliable selection criteria:
- a methodology that constructs an "eligibility filter", based on the criteria selected. excluding from funding those projects which do not contribute to the intervention objectives and EU policies on employment, sustainable development and equal opportunities; and
- a procedure that sets priorities for the funding of projects that overcome the eligibility filter.

At this point it should be mentioned that the eligibility filter should not only take into consideration the conformity to the EU policies, excluding projects that for example have some negative environmental impacts but the development and cohesion objective served by the specific project. These two requirements should be balanced at the priority setting phase of the selection procedure using a scoring and weighting system. In doing so further elaboration of the project prioritisation methodology and especially on the scoring and weighting system is necessary. In order to do so, specific studies by category of intervention should be conducted, since a universal approach for all type of actions and development priorities is impossible,

European Commission has played a very important role in initiating and guiding the development of evaluation methods. but there is still a lot of additional work to be done. Evaluation methods need to be further elaborated and improved for the results to have any credibility and be used by policy makers. Improvement should go beyond the definition of different sets of indicators and should also cover the methods that ought to be used for the analysis and interpretation.

The evaluation of the impacts on sustainable development is an area where the efforts should be focused since it is the most complicated. and all the approaches developed so far. mainly by International organisations are not fully compatible with the logic of Structural Funds interventions and the evaluation practices used hitherto. The indicators and methodological issues presented in this study are starting points that should be further developed.

Further efforts are also needed in order to create a more cohesive methodology and set of indicators for the evaluation of impacts on equal opportunities.

In addition there is a need to develop methods that will synthesise the top-down and bottom-up approaches. Top-down approaches need to be further elaborated improving the macro-economic models used and diffusing the results and the experience throughout the Member States and regional authorities.

Further improvements are also necessan. on the collection of statistical data that should be appropriate in order to measure the expected effects at various programming levels.

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l Introduction

Policy interventions within the scope of regional economies have been increasingly relying on the assumption that at the core of the economic processes lies technical change and innovation. Sustained competitive advantage is based on the technological and innovative potential developed within the regional economic and institutional milieu.

The effects of technical change and the policy alternatives that are adopted have penasit-e effects throughout the social and economic fabric. Economic and institutional structures evolve through continuity and creative destruction as a result of technical change. Competition, cconomic and industrial networking, industrial relations and production practices are affected to a greater or lesser degree by the implementation of new or improved techniques or technologies.

The interaction between society and nature is also fundamentally affected. The potential impacts. which technical change and policy choices may have on the environment. operate through highly comples mechanisms. New economic and technological activities and changes affect employment. quality of life and the exploitation of natural resources.

Therefore policy makers, both in regions and in European Commission. should take into consideration the potential opportunities and threats of technology during the planning. implementation. and final assessment of the interventions supported by Structural Funds and the Cohesion Fund.

On the other hand European Commission' and Parliament: have expressed in many occasions the opinion that current practices and methods used for the evaluation of projects and interventions funded by Structural Funds and the Cohesion Fund need improvement in order to ensure that they satisfy the main EU policies.

Following the Amsterdam treat!.. a series of EU policies are under revision. With respect to the Structural Funds and the Cohesion Fund in particular. a new strategic perspective is under discussion. in the contest of 'Agenda 2000'. Consequently. the tools used to plan. monitor and assess their impact are also under revision.

The objective of the present stud? is the improvement of the planning system. the selection of projects and the assesment of the impacts of regional programmes in order to ensure:

- that intervnations funded by Stractural Funds are in line with the main EU policies end espesialy those on suatainable development and environmnet. employment and equal opportunities: and
- better exploitation of the opportunities and to confront more effectivily with the threats of technolog!..

Any approach towards this direction should take into consideration two key points. First the rich esperience gained so far from the evaluation and implementation of Structural Funds regional interventions. as well as the international experience and practices. The Directorate General XVI of the European Commission has undertaken significant initiatives for the improvement of

[1] COM (95) 509 final on Cohesion Policy and the Environment. or the draft Communication from Mrs Wulf-Mathies on Community Structural Assistance and Employment. EN16/95/04980400.P00(FR).

- European Parliament (1996)

the evaluation process. such as the co-ordination of evaluations, the organisation of conferences and the preparation of studies and guides on certain issues of the e s ante. on-going (or mid-term) and e s post evaluation. Example of DG XVI's efforts is the organisation of the programme MEANS aiming at improving the Methods for Evaluation Actions of a Structural Nature which published a series of handbooks and documents and organised conferences on methodological issues. DG XI and DG V have also contributed to this goal, preparing guides on environmental assessment and gender impact assessment respectively.

At the international level various organisations have significantly contributed on the improvement of the impact assessment of policy interventions and individual projects. For example reports published by OECD, WWF, International Union for the Conservation of Nature and National Resources (IUCN) and European Environment Agency give valuable insight on the assessment of the impacts of policies and projects on the environment and sustainable development.

Second the specific features and the structure of the interventions, as well as the negotiation procedures followed by the Commission and Member States for the final approval of the interventions. This will be the additional parameter that will shape the methodological framework for the evaluation interventions.

2 The Programming Framework

Methodologies developed for the evaluation of the impact of Structural Funds interventions should take into consideration the mode the interventions are structured (in the form of programmes, sub-programmes, measures etc.) and their intervention logic. Also, the procedures for the selection of projects and the evaluation strategy should be in line with the procedures used for the planning, approval and implementation of the interventions,

2.1 Intervention Logic of a Programme of Regional Assistance

Programmes of regional assistance are designed with top-down logic (from the general to the specific). Each intervention in the form a of Single Programming Document (SPD) or Operational Programme (OP) serves a ***general objective.*** **The** fulfilment of the general objective requires that certain priorities for action are set, corresponding to ***specific objectives.*** Each specific objective is implemented by measures that serve ***operational objectives.*** **As** a result. this top-down approach on setting objectives results on an intervention with a tree-like hierarchical structure as can be seen in Figure 1.

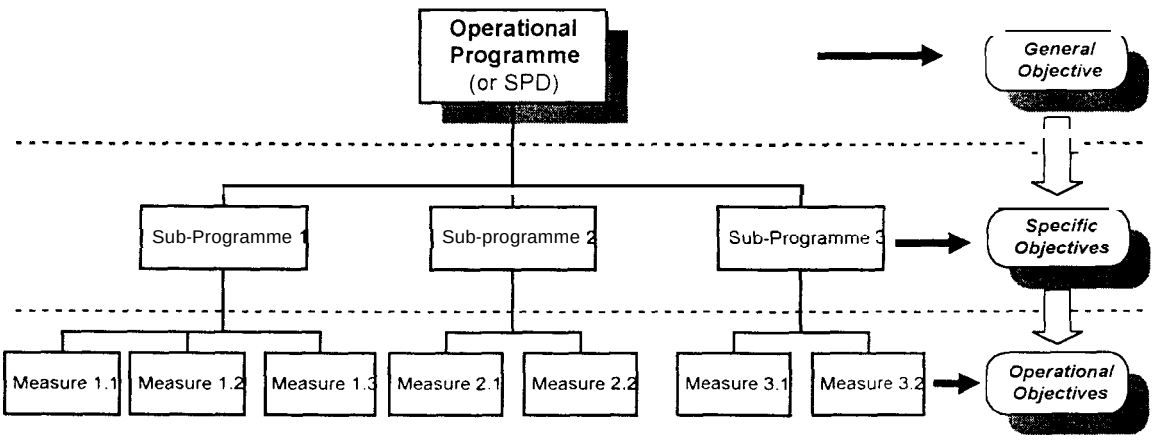


Figure 1 Structure **of an** Operational Programme or Single Programming Document

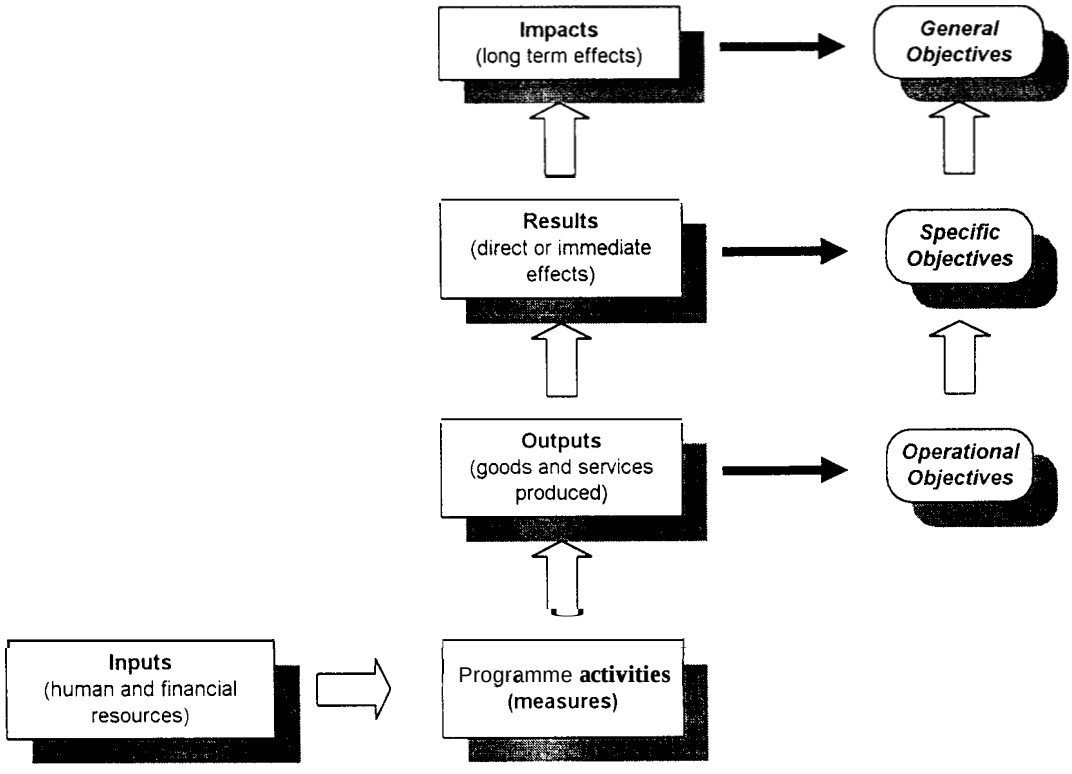
The implementation of an Operational Programme or a Single Programming Document and the aschivement of their objectives is a bottom-up procedure (from the specific to the general) which includes the following levels':

- Measures. consisting of projects, are implemented by administrations. agencies or operators using financial resources, human resources and other inputs.
- The implemented projects included in the measure give a series of outputs (e.g. number of SMEs assisted, **kW** power installed). The outputs provide a measure of the progress made in implementing the measure towards the fulfillment of the operational objectives of the intenention.

[3] See also European Commission (1998d)

- Outputs affect the direct beneficiaries of the measures financed. producing results (e.g. number of **SMEs** bringing to market new products, decrease of electric power interruptions) satisfying the specific objectives of the intervention.
- The results in turn produce impacts. that satisfy the general objectives. which are the main point of reference for judging the success or failure of the intervention. These impacts may be specific (e.g. increase in turnover of assisted firms, decrease of dependency on electricity imports) or general such as the creation of lasting jobs.

The above approach is expressed in Figure 2.



Source: European Commission (1997e)

Figure **2** The bottom-up approach **of a** programme

2.2 Life cycle of an Intervention

The creation of an intervention of regional assistance Co-financed by Structural Funds and the Member States is a rather comples procedure with many steps, consisting a "life cycle". The steps of this "life cycle" could be grouped into three main phases:

- the phase of E s Ante Evaluation.
- the phase of Implementation: and
- the phase of Monitoring and Evaluation[4].

The Ex-Ante Evaluation Phase consists of the following steps:

[4] See European Commission (1998a)

- The Member State or/and the Regional Authority prepare a Regional Development Plan in accordance with the Structural Funds Regulation and the Objective priorities relevant to the specific region under consideration:
- The Regional Development Plan is submitted by the Member State to the Commission for a prior appraisal and assessment (ex-ante evaluation) of its conformity with the requirements of the relevant Objective;
- Evaluation bp Commission services is followed by negotiations on the development strategy and priorities of the Regional Development plan, between the Member State and the Commission;
- The Member State and/or the Regional Authorities, in accordance to the finalised Regional Development Plan devise and agree with the Commission a programming document[5], which specifies the objectives and priorities. eligible measures. allocation of budget. monitoring and evaluation procedures and criteria, and general implementation requirements[6].

As soon as the programming documents (SPDs or Community Support Frameworks and OPs) have been finalised and agreed upon. the Implementation Phase begins consisting of the following steps:

- The Monitoring Committee is initially is established:
- Invitations for the submission of project proposals are issued;
- Projects are evaluated es-ante and selected according the criteria established by the Monitoring Committee in conformity with the broad criteria set out by the programming document;
- Funds are distributed and the selected projects are implemented

Monitoring and evaluation comprise the third and final phase including:

- Project monitoring:
- Interim evaluation of the programme aiming at the validation of the state of the programme. assesses the effectiveness of project performance and outputs, monitors spending against targets and suggests ways to overcome bottlenecks and shortcomings. Monitoring is carried out using as a reference the physical and financial indicators specified in the decision of the Commission that approves the specific programme'.
- Finally. immediately or one or two years after the programme has been completed an es post evaluation is being conducted.

As it comes out from the above description all the steps are strongly inter-liked. Decisions on the content of the measures and the evaluation framework taken in early stages affect the selection and the evaluation parameters of the projects at later stages.

Therefore it is important that all the potential impacts are identified earl! in the process of plan preparation and subsequently carefully considered and defined during the entire planning. implementation and evaluation process.

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[5] The resulting programming document is either a Single Programming Document (SPD) or a Community Support Framework (CSF) including Operational programmes (OPs).

[6] Council Regulation 2082/93 Article 5 and 8.
Council Regulation 2082/93 Article 25 (2).

3 Technological content of Regional Interventions and their links with main EU policies

One of the characteristics of the current Structural Funds programming period (1994-1999) is the special focus on research, technological innovation and technology transfer towards the regions. The main policy regarding technology followed by Structural Funds is to provide the regions with the necessary infrastructure for the modernisation and diversification of the regional economic structures. while on the other hand to encourage the regional and local actors to exploit the potential of innovation and high added-value industries in order to increase regional competitiveness[8].

During the first programming period stress was given mainly on the supply side. as R&D infrastructure and R&D skills were thought as the main pivot for the improvement of the technological capabilities of the regions, In the second period the priorities changed and the programmes now focus mainly on the strengthening of the enterprise involvement in technology development (including research) and innovation. the technology transfer from the most developed to the least developed regions. and the training of users.

The above strategy uses technolog!. (R&D. technology transfer. innovation and information society) as an instrument to increase the competitiveness of regions and to promote economic cohesion across the Union. Apart from this, technology serves other policies of the European Union. like the policy for employment. environment and sustainable development and to some extent the policy for equal opportunities.

In order to describe the technological and R&D dimensions of the programmes Co-funded by Structural Funds. we will use a taxonomy that includes four major categories of interventions representing four major objectives: Increase of business competitiveness: Upgrading basic infrastructure: Support of primary sector and rural development: and Development of human resources

Within each category a further classification i n sub-categories has been made using as a criterion the technological content of the intervention. In each subcategory only actions with technological content. namely support for R&D and Innovation, technolog!, transfer and investments on technological infrastructure and projects in the framework of information society. have been included.

The classification and the description of the actions have been based on the Operational Programmes and SPDs of regions under Objective I (including Greece. Spain. Ireland. UK). regions under Objective 2 (Denmark, France. Finland. Sweden. UK) and Objective 6 regions (Finland and Sweden). Due to the similarities appearing in the approaches adopted by different regions. reference to specific programmes or countries has been made only for the cases that value is being added to the presentation.

3.1 Actions Increasing Business Competitiveness

Among the actions and measures used by Structural Funds interventions for the improvement of business competitiveness. two different types are linked with technolog!.. namely actions supporting R&D and those supporting innovation and technology transfer.

[8] European Community (1997). "The Structural Funds in 1996: **8th** annual report"

3.1.1. *R&D Actions*

The main objective of R&D measures supported by Structural Funds is the increase of the regions' competitiveness.

In many R&D programmes environmental research constitute distinct measure'. Also in several regions specific R&D measures aiming at the protection of the environment constitute part of broader environmental interventions[9].

Support of employment is usually an indirect objective of R&D actions, as employment is vitally dependent on the competitiveness and growth potential of firms. However. in some programmes an approach more direct towards employment has been adopted, by funding the development of R&D skills through training and PhD programmes[11].

Supported actions include:

- R&D infrastructure like buildings and improvement of laboratories in research centres and universities, building or improvement of R&D centres of excellence:
- funding of applied research in Universities and Research Institutes;
- direct support for industry, including grants and loans for research (with or without the collaboration of research organisations). and support for the participation in the Framework Programmes for Research:
- co-operation in technological development between various actors such as enterprises (especially SMEs). technolog!, centres and universities in areas other than those mentioned above, for example mobility of human resources among the various actors:
- development of human resources related to R&D. including training measures like postgraduate training. training of research workers. management training in the field of research and technolog!.,

3.1.2. *Innovation, Technology transfer and productive investments in business*

The major objective of measures specifically designed to promote innovation and technology transfer is the increase of business competitiveness. As in the case of R&D. support of employment is an indirect objective.

Protection of the environment and sustainable development usually is not among the specific objectives but it is included among the funding priorities especially when related to the introduction of clean or energy saving technologies.

Actions do not exclusively concern women but are likely to have an impact on the promotion of equal opportunities. Example are infrastructures that support innovation (e.g. the "European centre for enterprise and innovation" in Puglia. Italy) having women as their main target group.

Supported actions include:

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[9] See for example the Greek Operational Programme for Research and Technolog!. Measure 1.1

[10] Example is the Operational Programme "Environmental Services" in Ireland. (Government of Ireland 1994b). or the programme PITMA II environmental programme in SPAIN (Ministerio de Economia y Hacienda. 1995)

[11] See the Spanish programme "Science Infrastructure" ((Ministeriode Economia y Hacienda. 1994)

- development of infrastructure for the support of innovation and technolog!. transfer including among others, technology transfer centres, technology and science parks. technology activity centres, or information technology networks ;
- direct support for industry, including grants and loans for product and process innovations (i.e. improvement or development of new products and processes) and support for the participation in the Framework Programmes for Research;
- investments in firms aiming at the improvement of the production systems including data processing (robots, CAD/CAM systems. automation control. planing and monitoring of production), improvement of product quality with the introduction of systems of quality assurance (ISO 9000) or Total Quality Management (TQM), equipment for qualit!. control, etc.
- introduction of clean technologies and clean production systems;
- introduction of energy saving and waste minimisation technologies:
- introduction of modem communication and information systems covering a wide range of procedures and activities.

3.2 Upgrading basic infrastructure

This category includes interventions that support the improvement of the economic and social infrastructure necessary for the sustainable development of regions. The range of intervention programmes is very broad, but not all of the programmes have important technological content. For example construction of roads constitute a significant part of regional assistance with limited technological contribution to the region. Interventions of this kind have been excluded from the analysis,

3.2.1. Information Society

Actions promoting Information Societv involve basic and advanced telecommunication services and infrastructure as well as data transmission applications. Both types of actions are used for the achievement of various objectives including:

- the reduction of regional disparities and integration of remote and isolated regions to the national. social and economic tissue (especially in Finland. Sweden. Greece[12]):
- the development of the economic base:
- the improvement of living conditions and protection of the environment:
- the development of human resources and the fostering of employment: and
- the creation of the necessan. infrastructure and services allowing women to increase their professional skills through distance learning. or to increase employment opportunitles through teleworking.

Actions and projects under the framework of information society represent one of the few areas where technology is utilised by Structural Funds Interventions in order to promote gender equality offering opportunities for women to reconcile family and professional life.

Actions being funded include:

- telecommunications services and infrastructure with emphasis on.

[12] Ministry of National Economy 1994b **and** 1994c. European Commission 1997b and 1997d

- digitalisation, modernisation and extension of networks; extension of the ISDN network and optical fibre links;
- improvements of the access of business users to advance telecommunication services such as the intelligent network services, cross-border advanced communication poles and vocal. optical and data communication networks;
- introduction of advance technologies like **RNIS** and ATM; estension of GSM coverage and development of satellite telecommunications services;

- data transmission applications related mainly to projects in the fields of
  - Government e.g. information technology systems for the improvement of management of public administration and the improvement of the effectiveness of its operations in the field of taxation, customs, finance and budget;
  - health and insurance services? e.g. information technolog!. systems for health authorities and distance medicine:
  - education funding application like distance learning and training in most of the EU countries. **In** some countries e.g. Ireland. applications for distance learning for the handicapped have been developed. Other actions being funded include networking of universities. technical colleges and public administration:
  - electronic transactions; teleworking: tourism (e.g. introduction of booking systems based on information technolog!.. advertising and trading via the Internet):
  - applications that reduce the barriers affecting the handicapped: development of virtual collaborating environments among enterprises (e.g. remote collaboration for design and product development. videoconferencing, links between suppliers and clients);
  - environmental monitoring systems (e.g. applications monitoring the marine and coastal environment): and
  - transport monitoring systems
- **Training** to provide a wide range of basic or advance information and communication technology skills aiming at the reorientation of employment or at the extensive use of new technologies in existing jobs. These measures focus mainly on areas eligible under Objectives **3** and 4.

Sweden and Finland'" are examples of countries worth being mentioned with an integral approach towards the information society. Interventions in these countries not only focus on the supply side investing on the necessary infrastructure but also concentrate on the improvement of demand through the development of applications and services. connecting schools to services, training users and improving the technical knowledge of employees.

3.2.2. *Energy Supply*

Technolog!. transfer in the energy sector is heavily linked with sustainable development and the protection of environment. The main objectives usually served by theses actions are:

- the reduction of the dependence on conventional fuel (e.g. oil). for energ!' production:
- the increase of flexibility and security of energy production with the diversification of energy resources and the improved exploitation of indigenous ones:

[13] European Commission 1997b and 1997d.

- the increase of the energy efficiency and conservation;
- the reduction of energy cost; and finally
- use of renewable and environmentally friendly sources of energy

Increase of employment is an indirect objectiv e achieved through the contribution of energy actions to the general development of regions.

More specifically actions Co-funded by Structural Funds include:

- Investments aiming at better exploitation of local energy sources like peat and lignite decreasing the dependence on oil.
- Building of natural gas energy plants or conversion of power stations from fossil fuels to gas-fired power generation.
- Investments in renewable energy for heating/cooling or electricit! production like wind power. small scale hydro power plants. energy production using biomass (e.g. wood and wastes). passive and active solar energy systems. geothermal energ!. applications in agriculture industn. and services as well as electricity production:
- Technology transfer in the form of investments or know-how that increases the energy efficiency. namely adoption of energy saving technologies, technologies that reduce energy losses or technologies that recover energy losses through recycling/recovering of wastes. products or materials and the introduction of energy management systems:
- Investment on small scale combined heat and power plants. aimed at improving the overall efficiency of particular buildings or industrial firms:
- Construction and strengthening of energy networks including the espansion and renewal of the power transmission lines and equipment for the utilisation of renewable energy sources.

3.2.3. Infrastructure for the protection of the environment and promotion of sustainable development

Projects for the protection of the environment and the promotion of sustainable development could be found in almost every category of actions, no matter what their main objective is, constituting a small complementary part of the whole intervention". For esample in Ireland there esists a specific Operational Programme for the environment". while at the same time a number of other Operational Programmes also have a significant impact on the environment according to the mid-term evaluation of Community Support Framen-ork of Ireland".

The major concerns of the direct or indirect env ironmental intenentions are the protection of the environment and the sustainable development. Specifically. the reduction of pollution problems in coastline. rivers: land and air: the espansion of public and private recycling and reuse: the increase of waste disposal destined for recycling: the increase of hygiene and quality of products from sustainable natural resources originating from previously polluted areas: and the increase of the health and biodiversity of the environment.

[14] For example in Denmark environmental protection is not a separate priorih in its two Single Programming Documents for North Jutland and Lolland. but is a part of other priorities. e.g. aid to business. supporting the adoption of clean technologies. In other regions e.g. Spain (PITMA II). Greece (Ministry of National Economy. 1994). [14]

[15] Irish Government (1994b)

[16] ESRI (1997)

Contribution to the employment is also another objective of environmental interventions through the promotion of environmental services like recycling, pollution cleaning services. rehabilitation of areas etc. for esample the case of SPD for Greater Manchester, Lancashire and Cheshire, UK or the Objective 2 SPD for Finland".

Direct environmental actions with technological content for the achievement of the above objectives are:

- Technolog!, and know-how transfer for: the development of the environmental infrastructure and services (such as water resource management: collection. treatment and recycling of industrial or municipal wastes: systems for environmental monitoring): creation of environmental protection industry (green industn); reduction of acidification and improvement of areas affected by acidification; clean up of coastal areas and river basins: minimisation and management of wastes: control and recovery of pollution;
- Research and other methods to reduce erosion and degradation of land. or to develop resource management methods; and
- Development of environmental espertise including development of education in ecological and environmental technologies: education and training on environmental adaptation and recycling.

3.2.4. Transport

Investment on transport technolog!. aims mainly at the provision of the essential infrastructural support for the development of productive sectors of the economy and the creation of long-term sustainable employment. The expected contribution of transport investments on the improvement of the environment is also significant as it facilitates the shift from private to public transport helping the reduction of congestion. accidents and emissions. the promotion of energy efficiency and the improvement of safety[18].

In these groups of interventions. technolog!. transfer takes the form of direct investments on transport facilities and equipment for the modernisation or expansion of rail. subways, airports and public surface transportation like buses. tram etc. Investments includ not only machines. wagons or other transport equipment. but also high technology information systems for control and monitoring. ticketing issuing etc.

3.3 Support of primary sector and rural development

3.3.1. Agriculture and Forestry

Technolog!. has also an important contribution on the development of agriculture and forestry. Infrastructures and 'soft' actions together with investments on technolog!. contribute to the restructuring and increase of competitiveness. and protection of the environment. Rationalisation of farming and woodcutting. reduction of water losses. reduction of emissions. energy saving as well as rice in the standard of hygiene are some of the goals related to the sustainable development and protection of the environment.

[1-] European Commission (1994b). European Commission (1997c)

[18] See also Government of Ireland (1994c)

The objectives of the actions with technological content are also linked with employment, with some variations relative to the area of intervention. The main objective is to maintain the overall employment even if it is reduced within certain sub-sectors.

In areas with an estremely low population density, i.e. Objective 6 regions[19], the objective is to increase employment by creating new jobs and by attracting new farmers. In theses areas technology transfer and adoption of research results help farmers to become more competitive and establish sustainable farming activities in the area. In areas with population drainage the aim is to ensure that a sufficient number of farmers remain, sustaining the socio-economic development of these areas. Additionally, technology transfer helps the modernisation of farms and the improvement of their competitiveness. Investments on food-processing industn.. especially in Objective 1 Regions[20]. create new business and expand the activities of the existing ones. helping in the creation of job opportunities in this sector,

Interventions under the Regulation (EEC) No 866/90 and No 867/90 aim at the improvement of processing and marketing conditions for agricultural and forestry products. Technology transfer particularly in the form of innovative investments contributes to the application of new processing techniques that help to develop new products and open up new markets. Although development of new technologies is not the main purpose of these interventions. they have demonstrated significant contributions to practical applications on an industrial or commercial scale of research and demonstration projects.

The supported measures include:

- development of new products creating new types of packaging which satisfy the evolving demand and improve product quality;
- investment in partly or wholly organic products and products produced from material which would othenvise be disposed of as waste:
- investments on logistics e.g. raw milk delivery systems. control systems for collecting milk. information management systems and handling facilities at terminals:
- penetration of new markets developing new products for non-food use. like new packaging materials and products for the strengthening and treatment of plants. for example organic plant protection methods;
- establishment of information technolog!. systems for farm buildings. on-farm processing facilities and farm infrastructure:
- improvement of by product recycling:
- investments for the improvement of energ!. efficiency and use of alternative energy sources:
- modernisation of collection methods using new techniques and equipment and:
- improvement of timber processing

Technology transfer under 2328/91 regulation can support: construction of greenhouses: installation of new trickle irrigation systems: supply of new technology cultivation tools and farm machine?: and improvement of waste management facilities to avoid the risk of pollution.

Apart from the investments under the specific Regulations. measures in the Agriculture and Forest? sectors support research programmes on: improvement of research infrastructure: im-

[19] See SPDs of Sweden and Finland (European Commission 1997b and 1997d)

[20] See SPD of Highland and Islands. UK (European Commission 1994c). or the Greek OP for Agriculture (European Commission 1994d)

provement and development of new agricultural products and species; development of new cultivation for bio-energy production: farm technology; input cost management: storage. processing and packaging: and cost reduction and qualit!. improvement in the food chain.

3.3.2. Fishery

Support in this sector follows the Common Fishery Policy of the European Community aiming at the achievement of a long lasting balance between fishing efforts and resources. Therefore, protection of the environment and sustainable development is one of the main objectives of the actions. Technology is mainly related to the diminishing of seawater pollution from wastewater and fuels from ships, the minimising of adverse effects to the environment. the improvement of the hygiene conditions and quality of products and the improvement of working conditions on ships.

Employment is related only indirectly with the objectives of the actions. and it is linked mainly with the contribution of technology on the viability of new fish farms. processing companies and other fishery-related enterprises already established,

Supported actions with technological contents include:

- technology transfer for the renewal and modernisation of the fishing fleet i.e.: the development and installation of selective gears and fishing methods; improvement of quality: improvement of safety and working conditions; building of dragnet boats and new multipurpose ships
- modernisation of fishing ports including technology transfer for: building storage and refrigeration facilities; mechanical and other fishery related service activities:
- improvement of processing including technology transfer for: modernisation of production and packaging facilities: product development: minimisation of the adverse effects of processing activities to the environment: and improvement of hygiene conditions and product qualit!.: and
- development of aquaculture including: development and installation of new cultivation and feeding techniques: modernisation and rationalisation of existing establishments: quality improvement: improvement of hygiene conditions and product qualit!.: minimisation of the adverse effects of aquaculture to the environment: oceanographic research for the development of aquaculture.

3.3.3. Rural Development

Rural development is heavily depended on agriculture and forestn as these two activities represent the two most important forms of land use in these areas according to the conclusions of a conference in Cork (Ireland) on 7. 8 and 9 November 1996[21]. The decline of these two activities increasingly threats the prosperity and the environment of rural communities.

Therefore support for rural areas sets as a priority the fight against poverty. the increase of employment and improvement of equal opportunities, the improvement of living standards and quality of life. the protection and improvement of environment ensuring sustainable rural development.

[21] The conference brought together policy makers and specialist from the 15 Member States. the Mediterranean countries. the countries of the Central Europe. USA and Japan.

Nevertheless ensuring of equal opportunities is one of the priorities of these interventions, technology seems to have vary weak or not at all links to the achievement of this objectives with the exemptions of the support of information society applications for distance learning.

Investments in rural areas aim at the diversification of business activities reducing dependency on agriculture and forestry, improvement of education and living conditions etc.

Technology is involved in actions like:

- Development of information and communication technology infrastructure and applications in order to improve and enhance local services like telemedical systems. care-administrative systems. access to business information sources, access to libraries, distance leaning:
- support of new business activities e.g. building IT applications and sen ices that disseminate data of cultural and historical significance for both local community and visitors in order to assist the development of tourism business activities in the area:
- technology transfer for actions increasing business development;
- research and development activities aiming at improving the conditions for production based on primary products of the rural area. for example methods of handling and producing food on a small scale. producing in an environmentally friendly way. or distribution of farm-produced food:
- reduction of incidence of surface and ground water pollution attributable to farm activities; and
- innovative methods of recycling and disposal of chemicals, farm effluents and animal waste.

Significant is also the transfer of technical knon-how for the development of professional standards in environmental management,

3.4 Human Resources

Development of human resources has been seen as an important tool aiming at:

- bringing supply in the labour market in line with demand:
- improving capabilities of the labour force: and
- increasing professional qualifications of women and reducing difficulties in entering the job market.

Even though training subjects depend on the specific needs of each region. a significant part of the training effort in all Member States is directed towards information and communication technologies under the framework of information society. Important is also considered the training of human resources related to R&D and innovation, as it has already been mentioned in the R&D and Innovation section.

Moreover technology transfer and innovation are related to the development of teaching tools and methods. The aim is the improvement of training systems developing new training methods based on applications of information and communication technologies. and nen multimedia teaching tools.

4 Positive and negative impacts of technologies and their links with main EU policies

In this chapter the impact of the technologies intridused by the interventions funded by Structural Funds on the environment, employment and equal opportunities is being analysed. The impact of technology is not independent of the specific action and the general objectives that this action serves. For this reason the taxonomy presented in the second chapter is being used, regarding technology as an integrated part of a broad action.

Analysis of impacts is based on a synthesis of studies mainly conducted by international or European organisations (e.g. OECD or European Environment Agency) utilising esperience gained from a wide range of countries. European Conunission is now conducting thematic evaluations of the impact of Structural Funds' interventions on environment but these were not yet available at the time this report was being prepared. Alternatively. a number of mid-term evaluation studies for specific operational programmes were used in order to support the analysis with figures. However. the usefulness of these studies was restricted because evaluations are concentrated on the impact of whole measures without paying attention to particular technologies. The evaluation studies can be fully utilised only in cases where a whole measure or subprogramme is linked with investments on specific technologies[22].

4.1 Impact of Technology on Sustainable Development and Environment

In the past technology was designed and used under the tacit assumption that energy and raw material were unlimited and that the environment represented a free disposal area for any unwanted residues of the production process or the product itself[23]. This manipulation of technology led to serious environmental degradation. Therefore technology became the vehicle of many environmental disasters. It is globally recognised that future development will depend upon the existing technologies and the technological advances being made in the coming decades and the sustainable use of technology.

Technological innovation and diffusion will critically determine the pace and character of future economic development and environmental management. Moreover it is recognised that technology is a key factor that will contribute to a significant extent in solving environmental problems and supporting sustainable development. The role of R&D and technological innovations in leading to clean environmental technologies has been widely recognised during the last decades. A recent report[24] on Europe's Environment, cites in the concluding remarks that to achieve sustainable levels of environmental pressure and use of resources, it is likely to require major technological advances and major shifts to less resource - intensive and environmentally harmful activities.

Technology used in actions funded by Structural Funds has different levels of environmental impacts. The direct or indirect effects, as well as the negative or positive results on the environmental conditions, depend on the nature of the projects / actions and the objectives they tar-

[22] For example Subprogram 3: "New technologies for new advanced telecommunication services" of the Greek Operational Programme for Telecommunications)

[23] OECD(1995b).

[24] EEA (1998).

get for. The following analysis of the environmental impacts of technology is based on the classification of the actions that incorporate technology, according to the major objectives of the programme interventions, presented in chapter 2 of this stud!,.

Environmental impacts will be outlined and presented in a qualitative manner.

4.1.1. Effect of R&D on environment and sustainable development

The environmental dimension of R&D is not always obvious. In order to predict or measure the environmental impacts clear description of the scope of each project is required.

Actions related to infrastructures for R&D, have direct negative environmental effects when building erections and site formations are being involved. The environmental impacts can be distinguished to those appearing during the construction phase and those during the operation phase. During construction all environmental media[25] are affected but the level and the seriousness of environmental impacts depends on the scale of the infrastructure. Moreover during operation the impacts may be significant and harmful to the environment.

The possible impact of laboratory constructions during operation could be air emissions of hazardous and toxic substances originating from laboratory reactance, as well as combustion of laboratory solid wastes that could cause air pollution. Disposal of liquid and solid laboratory waste may cause significant soil contamination. The level of toxicity of the emissions and wastes from laboraton activities will determine the level of impacts and the level of pressure exerted to the environment.

4.1.2. Effects of Innovation, Technology Transfer and Productive 'Investmenton sustainable development and environment

The aim of these actions is to increase business competitiveness, by modernisation and diversification of their activities. The level and the significance of the environmental impacts caused by this type of actions depends on the type of investments and the business sector

Improvement in production systems includes actions to support industn for process innovations. This can lead. in many cases. to business expansion, Expansion in business has a different range of environmental impacts, Reduction of air quality due to harmhl air emissions (Greenhouse gasses. ozone depletion substances. particulate matter, dust. odorous. toxic and hazardous emissions), water pollution due to waste disposal. soil and land degradation duc to raw material extraction. visual effects are the main negative impacts.

On the other hand positive impacts on environmental media (air, water. soll. land/nature) can be induced by this type of actions. if they are introduced in the monitoring of production, in systems of quality assurance. in total Quality Management, in Environmental Management Systems etc.

Actions. which introduce clean technologies and clean production systems have direct positive impacts on environmental media. Energy saving and waste minimisation technologies have also direct positive impacts. These types of actions are based on innovative technologies. which serve the sustainable development and quality of life. These technologies contribute to a great estent in reduction of harmful air emissions. liquid and solid wastes, the reduction of the risk of soil contamination and support of the sustainability of the natural ecosystem and wild life balance.

[25] Environmental media: air. water. soil/land. nature/wildlife. resources . landscape

In general. for the case of industrial activities the main parameters that determine the type and significance of environmental impacts are the[26]:

- type of product manufactured, procedures used;
- raw materials used, content of fuels and ores:
- resource use intensity (air, water, energy):
- size of plant and location and surroundings environment;
- technolog!. being employed:
- dispersion potential of emitted pollutants (including those from accident occurrence): and
- resource efficiency of the manufacturing process (particularly energ!. with respect to air emissions)

The status and effectiveness of technology employed, the environmental abatement equipment and the effective training and management of staff, determine the level of emissions from industrial plants of equal capacity in different regions.

4.1.3. Effect of information and communication technologies on sustainable development and environment

Projects in this group aim to improve telecommunication infrastructure by introducing advanced telecommunication technologies. like digitalisation of networks, ISDN networks. GSM coverage. satellite telecommunications. data transmission applications etc.

It is not possible to forecast the direct environmental impacts (positive. negative) originating from these actions. Applications of this type of technology may support environmental sustainability, for example application to environmental monitoring. Environmental monitoring[27] became attainable and applicable due to telecommunication and electronic technology. Environmental information (databases etc.), i.e. pollution readings and data acquisition. prediction and prevention of natural or human based catastrophes, are some applications of information technologies, which can have positive environmental impacts.

Data transfer has also indirect positive effects on environment. It reduces the need to travel between places and therefore reduces the negative effects originating from the transport sector (i.e. reduction of air emissions by cars). Health risks have been reported due to GSM technology, but this is still under investigation, since there is no clear supporting scientific proof.

4.1.4. Effect of energy technologies on sustainable development and ensironment

The energy sector is one of the most pollutant sectors along with the industn. sector. **All** types of energy technologies have potential environmental impacts. at varying degrees. throughout their cycle. from production extraction through processing to end use. Specific impacts can vary considerably depending on the type of energy technolog!,. but also on the efficiency of the technologies employed and the use of pollution control technologies.

Projects supporting improvements on the exploitation system of local Energy Sources (mainly peat and lignite) mainly have negative environmental impacts. They result to a reduction of the natural resources supply, land and soil degradation and loss. air emissions of Greenhouse gasses and ozone depletion substances from combustion of fuel for electricit!. production. water pollu-

[26] Europe's Environment: The Dobris Assessment

[27] Remote. real-time data transfer

tion from liquid mine wastes and depositions of acidifying compounds. disturbance of natural habitats, esploitation of wilderness of natural areas for surface mining.

Establishment of natural gas energy plants result in environmental degradation. All environmental media are infected by this type of activity to a lesser or greater level. Air is surcharged by gases emitted by burners, natural energy resources is reduced, water is polluted from thermal release from cooling process, raising water temperature, in addition to impacts on the landscape from plant erection and electricity transport lines. The utilisation of natural gas in energy production systems is nevertheless considered as a clean technology compared with oil based energy production. since combustion of natural gas has fewer consequences to atmospheric pollution.

Energy efficiency and energy saving technologies projects contribute to a significant degree in environmental conservation. These technologies aim to reduce the harmful effects of energy plant operation. It must be mentioned that the applications of these technologies can reduce the level of pollution only to a certain estent. In other words even if these technologies can have an advantage over the environment the continues operation of the energy plants will still add pollutants in a cumulative manner.

Small Scale Combined Heat and Power Plants contribute both negative and positive environmental effects. This type of energy plants improves the energy efficiency and utilisation. The main benefits come from the extraction of thermal energy. being produced. in the first cycle. Utilisation of this thermal energy to satisfy heating or energy demands can reduce the use of natural energy sources, and contributes to the sustainable management of natural resources. Also the final temperature reduction of gases or steam being released reduces the effect of global warming. Negative environmental effects induced from the operation of these plants. originate mainly from the gases emitted to the ambient air from fuel combustion

Renewable energy technologies are clean technologies. The greatest advantage of these technologies is that they utilise renewable energy sources, which is of vital importance in the sustainable management of environment. Even if the positive direct impacts of this technology are not being disputed. there are some negative direct impacts on the environmental media. These impacts are less harmful compared to other energy sources and technologies. Hydropower projects influence negatively the hydrological cycle (re-routing of rivers). the soil and wild life due to flooding effects upstream of the dam, visual intrusion and landscape changes due to dam and associated infrastructures.

Biomass contributes to air pollution with combustion of gases and particulate matter. eserts pressure on landscape (energy plant). and supports soil degradation monoculture and soil compaction.

Emissions to air. water and soil. contamination from losses from piping are the main negative impacts of geothermal energy. Decomposition of photovoltaic results in toxic pollution. Pressure on land use. visual intrusion and noise effects are the negative environmental impacts of wind Farms and Solar parks.

In addition energy network projects have negative visual effect on the landscape (high voltage transport lines, pillars).

4.1.5. Effect of environmental technologies on sustainable development and environment

Actions under this intervention include projects for technology and know-how transfer for waste minimisation, research and development of methods to reduce erosion and degradation of land and development of environmental expertise. The positive direct environmental impact of these actions is obvious. They support dissemination of clean environmental technologies and contribute to a significant level in the reduction of pollution levels and the recovering of polluted environmental media in local level.

4.1.6. Effect of transport technologies on sustainable development and environment

Projects under the intervention have limited technology transfer. Actions financed by the regional programmes include construction of main transport infrastructures like rail. subways, airports, highway etc. The transport sector is one of the main contributors to air and noise pollution mainly in urban areas. It is also an intense energy demand sector and therefore eserts pressure on natural energy resources. Moreover transport infrastructures (roads. ports) create negative direct impacts on soil/land. wildlife/nature. coastal zones etc.

On the other hand transport technologies could contribute to the reduction of congestion, accidents and emissions. the promotion of energ!. efficiency and the improvement of safety providing that they facilitate the shift from private to public transport.

4.1.7. Effect of technologies used in agriculture and forestry on sustainable development and environment

The environmental impacts reviewed below are related to specific actions supported by Regional Assistance Programmes with strictly technological content. Therefore the impacts cover a narrow area of these two sectors.

Actions in compliance with 866/90 and 867/90 regulations cover different areas of agricultural and forestn. sectors. A large number of these actions have direct positive impacts on the environment, by introducing technologies and practices that minimise the harmhl effects of agricultural activities. Application of organic agriculture practices contributes to a significant level on the sustainability of the ecosystem and improvement of the quality of life Organic agriculture practices eliminate soil and water pollution from undesirable and toxic compounds and in addition improve the soil stability and organic matter and reduce soil erosion risk. Organic products eliminate the health risk from pesticides residues. secure the proper environment for wildlife habitants and maintain the ecosystem balance. Product recycling, energ!. efficiency and use of alternative energy sources (renewable energy) are projects that have direct positive impacts on the environment. Projects that support the mechanisation of farm practices improve the farm efficiency and standards of living of urban population. Environment degradation may be caused from these actions, Mechanisation of agriculture usually leads to more intensive cultivation. which increases the farm imputes like energy. fertilisers and pesticides.

Projects that support technology transfer to farms and are in compliance with 2328/91 regulation contribute to environmental protection. Installation of new trickle irrigation systems improves the water application efficiency. This has positive impacts on water resources since it reduces the volume of water being used (minimum losses). This technolog!. contributes to keep the water in sustainable level. to reduce the risk of salinisation /alkalisation. to keep the qualit!. of surface and ground water in acceptable levels and lower the abstraction rate of nater resources. Projects of waste management of animal raising facilities (manure handling and disposal) reduce the risk

of surface and ground water pollution (eutrophication, oxygen depletion) and from soil contamination. Agricultural mechanisation (new technology cultivation tools) improves the general efficiency of the farms. but also has some negative impacts on the environment. Emissions of combustion gases from internal combustion engines contribute to air quality degradation. soil combustion and moreover the resulting intensive cultivation can increase soil erosion risk. Mechanisation contributes also in a direct way to soil and water contamination, by introducing intensive agricultural practices which are closely related to high rate-use of chemicals fertilisers and pesticides.

Research projects financed by the Regional Assistance Programmes cover different areas of A g ricultural and Forest sectors. The environmental dimension and the environmental impacts of these projects are not directly visible in many cases. The effect on the environment depends also on the application of the final outcomes. For example projects that support the dcvclopment of new cultivations for bio-energy production (biomass plantations) have an environmental impact by boosting renewable energy applications (biomass) in addition to the direct environmental impacts described in section 4.1.4. The positive and negative impacts on the environment from the biomass energy utilisation are described in section Upgrading Basic Infrastructure - Energy Supply.

4.1.8. ***Effect** of fishery **on sustainable** development **and environment***

Supported actions with technological content focus mainly on the reorganisation of the fisher! sector. The importance of technology employed for the environmental protection depends on its application.

Technologies supporting the renewal and modernisation of the fishing fleets have a general positive effect on the conservation of marine environment since the main objective of these actions is the sustainable exploitation of fish stock. Protection of marine water from wastewater and fuels from ships is also shared by these actions.

Modernisation of fishing ports has positive and negative environmental impacts. Technology applications for diminishing marine water pollution from port activities (oil leakage. wastewater collection and treatment etc.) protect the coastal environment. Construction of infrastructure (storage buildings. refrigeration facilities) n-ill induce environmental effects. mainly during the construction phase.

Technology transfer to improve fish processing has positive and negative impacts on the environment. Positive impacts arise from the application of clean technologies (wastewater treatment plant, solid waste handling and disposal or recycling system). Negative Impacts originate from energy demand and utilisation, increase in raw material and exploitation of resources (reduction of fish stock, water use) pollution from wastes etc. Fish processing activities fall into the general sector of food processing which is characterised by a certain environmental behaviour.

Development of aquaculture has a number of effects on nater, nature and wildlife. Discharge of surplus food and animal wastes from fish farms cause water eutrophication. use of anti-fondling paint on aquaculture facilities pollutes the marine water. Marine ecosystem is affected by physical barriers established in order to create fish farms, and by human activities around the fish gages. In land aquaculture, the negative environmental effects of installations arise from visual interception of buildings, disposal of process wastewater (eutrophication). and increase on demand of fresh water (intensive esploitation of natural resources).

The development of aquaculture reduces the pressure eserted by over-fishing on natural fish stock, covering a part of the increasing demand for fish products.

4.1.9. Effect of technology used for rural development on sustainable development and environment

Reduction of Surface and Ground Water Pollution risks from farm practices. innovative methods of recycling effluents and minimisation of pesticides are two sets of action. under the development intervention, that lead directly to the protection of the environment. Since agriculture is recognised as a major non-point pollution source, these actions are of vital importance for conservation of natural ecosystems. natural resources, human health and qualit!. of life in rural areas. The main benefits of these actions are the improvement of surface, ground water and marine water (coastal zones), soil stabilisation and erosion control, conservation and increase of threatening natural species, clean products (absence of pesticides combusts).

Other actions supporting technology transfer have indirect effects on the environment. like Information and Communication technology infrastructures, or technological investments supporting business development,

4.2 Impact of Technology on Employment

Many studies have underlined that technical changes and innovation drive competitiveness, productivity, long term economic gron-th and improvement of living standards:'. However at the same time economic growth does not seem to give rise to a comparable growth in employment. The case of Ireland is a good example. since the substantial increase in industrial output in the late 80's and early 90's did not translate into a significant increase in total employment[29]. On the contrary, the emergence and diffusion of innovation in products and processes seems to lead to significant structural changes, reallocation of employment and "technological unemployment". New technologies destroy jobs in some industries, especially among the low-skilled. while create jobs usually in other industries. with different composition of skills[30]". A real challenge and a measure of the success of this type of policy will be the estent to which increased competitiveness will lead to a net increase in employment.

Pianta M. et al (1996) suggested a useful framework for the analysis of "technological unemployment". Their model of analysis is going one step beyond the approach of classical economists. by taking into account the pressure of international competition on increasingly open economies and the globalisation of production and technology.

The effect of technological change on the intemational competition and division of labour can be seen as the result of two processes. On one hand. the introduction of process innovation (mainly through new investment) increases productivity and replaces labour. On the other hand. product innovation, based on internal innovative activities as well as on new intermediate or capital goods. creates new markets, demand and production and therefore new jobs (e.g. convergence of information and communication technology creates new telecommunication services).

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[28] Fagerberg (1994). Pianta (1995). Dosi. Pavitt and Soete (1990). Scherer (1992). Amendola. Guerrieri and Padoan (1992)

[29] Government of Ireland (1994)

[30] STOA (1995). OCDE (1997a)

According *to* the authors, the globalisation of production and markets allows the rapid international diffusion of innovation, which results to a greater competition and a restructuring of production activities in terms of sectors and phases of production localised in each nation. Structural changes within each country can alter its share in the value added to global production and can result in a different sectorial composition of national economies.

Therefore, the impact on employment is the net result of: **job losses** due to the direct labour-displacing effect of innovation and to the decline of particular sectors; and **job gains** due to the impact of technological change on the emergence of new sectors and of the expansion of certain traditional ones.

Hence, the estent to which the net effect of technology on employment will be positive or negative. is mainly dependent on the way technology is incorporated to the economy. More specifically it depends on a number of characteristics of the labour force, such as the relationship between the economy and the educational and training system as well as the flexibility of product, labour and financial markets[31].

This model also applies to the Regions of the European Union assisted by Structural Funds, where competition within the single European market results in a rapid diffusion of innovation throughout the Union. Diffusion of innovation is realised mainly through the technology transfer (imports of new intermediate or capital goods) from the advanced to the less favoured regions and through the development of indigenous technological capabilities at the assisted regions. Structural Funds' interventions facilitate the diffusion of innovation in favour of the assisted regions. This is made possible on one hand by funding the adoption (with the form of investments) of new or widely diffused in other regions process technologies, enabling the assisted regions to increase their competitiveness or to enter the production of new products or services (in existing or in new sectors). On the other hand by supporting the indigenous technological development, which in turn results in the development of process and product innovations. At the same time Structural Funds has an influence in the transform of the educational and training system, especially in the'' Objective I Regions. where their contribution is substantial in comparison to the national one.

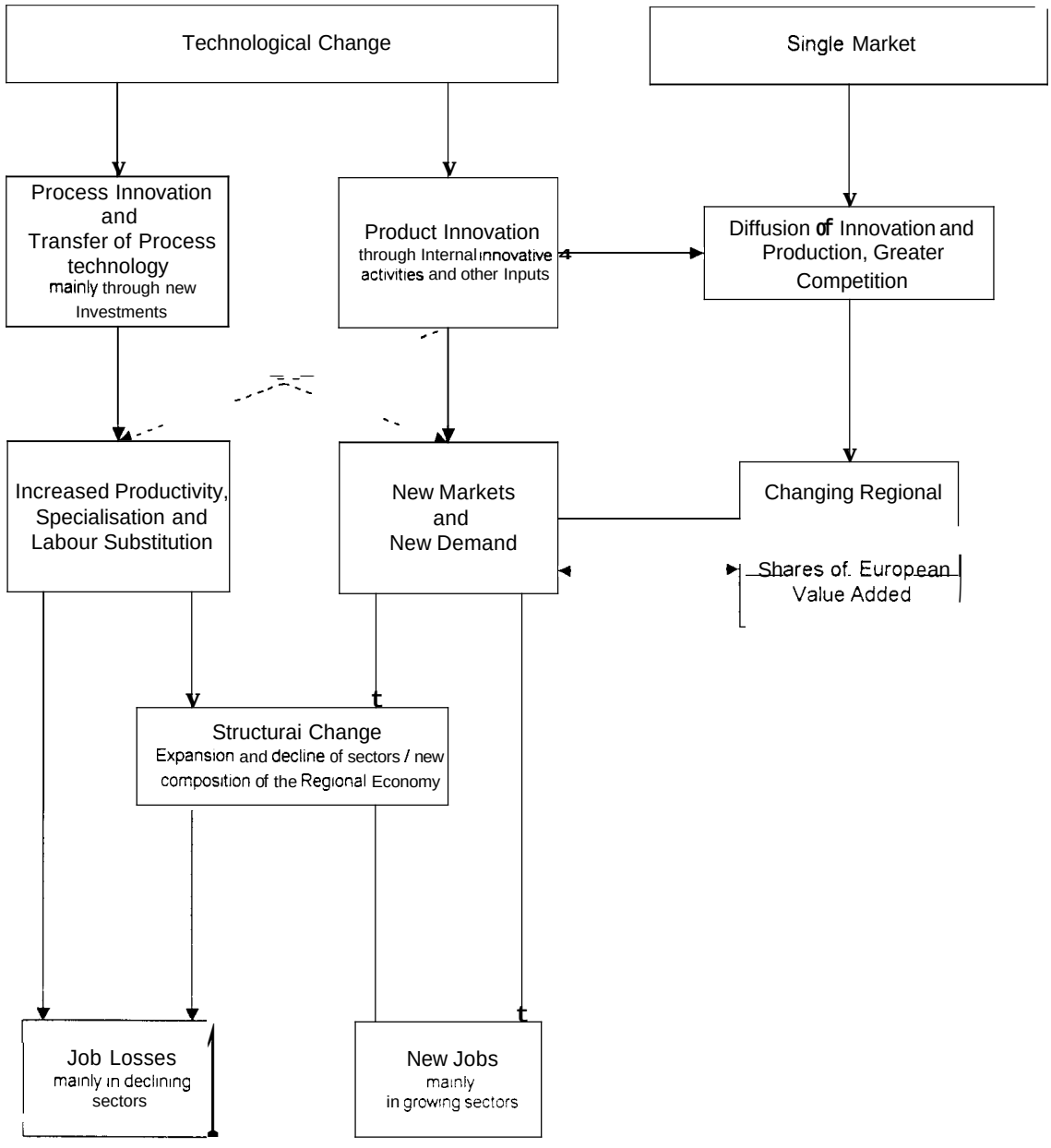
The above framenork of analysis is presented in Figure 3.

Consequently, estending the framenork of the analysis of Pianta M., the impact of the Structural Funds' support for technolog!. transfer and innovation development in regions is the net result of

- job losses due *to* the direct labour-displacing effect of technolog!, transfer and innovation and to the decline of particular sectors: and
- job gains (jobs created or safeguarded) due to the employment-creation effect of technological change (technolog!. transfer and technological innovation) and the growth of sectors influenced by the transformations of the educational and training systems and the adjustment: of the labour and financial markets.

[31] OECD (1998a). Spenner (1985) and Freeman and Soete (1994)

[32] Regions under Objective 1 include the whole of Greece. Portugal. and Ireland. the greatest **part** of Spain. the New Länder in Germany and smaller regions in other countries.



Source: Adaptation from Pianta M. et al (1996)

Figure 3. The impact of technological change on employment in European Regions

The model of the employment impact of Structural Funds Interventions with technological content should be further enhanced with the inclusion of three additional parameters[33]:

- Employment generated as an **indirect** consequence of the intervention either increasing the demand for goods and services produced in other sectors or improving the efficiency in the local economy
- Employment generated during **the implementation** of an intervention e.g. during the construction phase of a new power plant. the extension of transport networks or during the implementation of training courses. These type of jobs are temporan, by nature as they exist only during the construction or setting up phase.

[33] See also European Commission (1996)

- Employment generated due to **income multiplier effects** i.e. employment generated in 're-sponse to increased demand due to income rise resulting from the intervention. Example of such effects is the increase in local retail employment or in local house construction to meet the increased demand from the newly employed.

For the estimation of the impact of technology on employment, it should be also considered that the creation of new jobs in one location as a result of an intervention could occur merely because of the transfer of employees from another activity or location.

It is obvious from the above analysis that it is estremely difficult to come up with a quantitative estimate of the impact of technology or interventions with technological content on employment, as some effects are materialised faster than others and can depend on local. regional or national conditions while at the same time these can be accompanied by indirect effects. This conclusion is also supported by previous studies like STOA (1995). According to this study. much of the research on the impact of technolog!, on employment tends to be concentrated at the micro-level and more specifically at the level of one company or even of a single department due to the difficulties mentioned above. But calculation of the employment at the micro-level only provides estimation for the gross-employment created by the project or intervention. The calculation of the net-employment, that is the employment actually created or safeguarded. at the level of a region has to take into consideration the nature of the jobs created. the extend to which the! replace other jobs. and the effect on jobs existing at competitive firms in the same or other type of industries of the region.

In the following sections the effect of specific technologies and interventions with technological content on employment will be examined using the above-described anal! tical tool. The analysis will follow the taxonomy of interventions with technological content already presented in the second chapter.

For each intervention measures and projects can be grouped mainly in three categories namely. infrastructures support for SMEs and training. In each category employment effects are induced due to:

- the implementation of the project or measure (during the development of Infrastructure or the implementation of a specific project):
- the increase in productivity or the creation of new product and services within a sector (in the case of infrastructures) or within individual companies (in the case of support to SMEs or training):
- the increase of flexibility of the labour force:
- the impact on suppliers: and
- the impact on the local economy

*4.2.I. Effect of **R&D** on employment.*

The main effects of R&D on employment could be summarised in the following:

Temporary jobs are generated or existing jobs are temporarily safeguarded during the construction phase of R&D infrastructures (e.g. research centres) or the implementation of R&D projects.

The construction of new R&D infrastructures e.g. research centres or laboratories. has as a result the creation of new research services for the scientific community and industn.. In that sense, R&D infrastructure acts similarly to process innovations used for the creation of new or the expansion of existing services and therefore creates new jobs for research personnel and technicians, necessary for the operation of the infrastructure and the supply of the research services.

Creation or improvement of infrastructure can facilitate the long-term product and process innovations in client sectors which in turn can affect employment.

Funding of R&D projects contributes to the long-term generation of product and process innovations, mainly in science based or high technology firms. Product innovations create jobs due to the growth of firms and destroy jobs in rival firms or sectors. Process innovations decrease employment due to the rise of productivity and create jobs as a result of growth according to the analysis presented in section 4.2.

Funding of training projects either in the form of research courses or in the form of training of research staff increases the demand for university staff or trainers.

Training gained either by participating in research projects (learning by doing process) or through specific training measures. increases the qualifications of research personnel. affectin; positively the flexibility of the labour market. Also increases productivity and qualit!. of research services offered by research organisations and institutes which in turn affects positively the employment in the research services sector, Finally, training helps develop technological and research capabilities in companies. which in the long run will lead to the development of product and process innovations.

Finally. all the above activities will increase the demand for research instruments or for other inputs, resulting in an expansion of suppliers business and therefore will affect employment positively.

4.2.2. Effect of innovation and technology transfer on employment.

Impact of innovation and technolog!. transfer on employment follows directly from the analysis in section 4.2

Temporary employment for professions related to development of infrastructures such as technology parks, technology transfer centres or technolog?. transfer services. is created or safeguarded during the set up of infrastructures. Similarly temporan. employment is created or safeguarded during the implementation of technology transfer or innovation development projects. Employment is also generated for the operation of the new infrastructure and the formation of' the new or improved technolog!, transfer and innovation services.

New or improved infrastructures support firms to develop process or product innovations and thus affect employment.

Investment on new processes in firms usually based on information technology e.g. CAD/CAM/CAE or monitoring and scheduling, increases productivity and reduces employment. Jobs are generated when the market share increases faster than the productivity. On the other hand. product innovations or investment on clean or energ!. saving technologies increase competitiveness. which in turn leads to employment generation or safeguarding in investing firms and to employment decrease in rival firms and declining sectors.

Technology transfer and innovation in firms have also indirect effects in employment. Employees participating in such projects increase their skills and competencies (learning by doing) and therefore increase the efficiency of innovation and technology transfer projects.

Additionally innovation and technology transfer projects increase demand for consulting services and process technology products affecting positively employment within these sectors.

4.2.3. Effect of information and communication technologies on employment

According to many OECD studies". diffusion of information and communication technologies (ICTs) by itself does not reduce or increase the overall employment. It does eliminate a lot of unskilled manufacturing or clerical jobs, but it also creates jobs, both in skilled professional occupations as well as unskilled services. Overall. the dominant trend in the composition of skills is towards the automation of routine tasks and the re-training and upgrading of work content in middle-level categories'ï. However. the net result on employment it is not self-evident".

The convergence of the field of information technologies with that of telecommunication technologies creates new telecommunication services and products in the ICT sector. Improvement and further development of telecommunication infrastructure (e.g. digitalisation of network. extension of GSM coverage, extension of ISDN network and introduction of ATM technologies) on one hand, improves existing and creates new basic telecommunication services, and on the other hand affects a wide range of different sectors.

Historically, infrastructures have played a key role in developing and espanding markets. However estimating the link between investments in infrastructure projects, and long term net contribution to employment has always been problematic. This is by far true for ICT. According a resent OECD stud!." the significant spillover effects of information and communication infrastructures and their applications pose serious difficulties when attempting to measure their impact.

Whereas. the OECD concluded in earlier work that investments and increase of efficiency of public telecommunications operators will open up employment opportunities within and beyond the telecommunication sector[38] i n a resent OECD study" it was concluded that in many competitive markets. digitalisation of networks has been combined with downsizing of labour force in Public Telecommunication Operators (PTOs). Only in markets where infrastructure competition was being allowed. new entrants helped stabilise employment levels.

On the other hand. competition and technolog!. squeezed prices allow the emergence of new services that lead to market espansion and the creation of new employment opportunities in the telecommunication services sector. Esploitation of new services by operator companies creates "telecommunication jobs" within companies. Hence many employment opportunities are being transferred into operator industries".

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[34] See OECD (1997a). OECD (1997b). OECD (1998a)
[35] OECD (1997a)
[36] OECD (1997c)
[37] Ibid.
[38] OECD (1994)
[39] OECD (1997c)
[40] Ibid.

Digitalisation of networks. spread of ISDN and ATM technologies and accelerated investment in transmission technologies including fibre optics. revitalise demand for the telecommunication equipment industry. Nevertheless. it is espected that this espansion of the market will not be translated to significant employment gains in equipment industry due to the cost of developing this new equipment and the limited number required even in the most developed markets. Furthermore, production of new equipment is to a great extent automated with restricted need for labour. Also laying the optical fibre cable is now capital intensive with reduced maintenance. Overall, the trend is the reduction in employment level in the equipment industry and the change in the composition of skills towards software development. Exception to this trend is the market for terminals for multimedia applications such as video-telephony, video-conferencing and interactive television where significant espansion is espected in both market share and employment. However, as the production of communication equipment is highly concentrated in few countries the geographic impact will be limited"'.

Diffusion of information and communication technologies in operator sectors takes the form either of process innovations with an important impact on productivity and growth or the form of product innovations creating new products and markets. In both cases applications are mainly reliant on information and communication infrastructure and services,

Rather optimistic scenarios forecast a cumulative incremental growth of EU GDP between 1993-2008 of between 2.7 percent to 6 percent depending on the intensive or not usage of broadband networks[42]. Another study[43] estimates that broadband networks and information/communication technologies will bring about productivity gains that will add to a gronth of 2.7 percentage points to GDP and between 4-6 percent. if espansion is accelerated.

Sectors that increasingly rely on advanced communications applications (e.g. electronic commerce) are the banking sector. financial services, transport, tourism and the distribution sector. The retail sector is also adopting electronic market structures. Information and communication technologies are also increasing]!, applied in public administration. education. health services and manufacturing. Their espansion reduces employment due to the increase of productivity and replaces obsolete jobs with fewer new jobs that are being based on information and communication technolog!, skills. At the same time these sectors are expected to esperience significant growth[44]. However. it is estimated that the growth in output will not necessarily be accompanied by increase in employment, because the espansion will be now based on an organisational structure that demands significantly less employment[45]. Furthermore, job losses are expected in firms. nhich loose their market share because of failing to introduce information and communication technologies in time, in order to retain their competitiveness.

[41] Ibid.

[42] Cattaneo. Gabriella (1993)

[43] European Commission (1994)

[44] OECD study on electronic commerce

http: www.oecd.org subject e_commerce ebooks PART6-E.pdf

[45] OECD (1997c)

4.2.4. Effect of energy technologies on employment

Investments on energy technologies funded by Structural Funds are directed towards the adoption of more environmental friendly energy production methods in the energy sector and towards the diffusion of energy saving technologies and practices in industry and households.

Support of investments on energy infrastructure and deregulation of energy production market will attract new energy producers in the regions. The result on employment is depended on the way the market will be divided amongst suppliers. If new energy plants substitute energy imports instead of displacing other suppliers, employment is expected to rise.

Also Investments on energy plants will temporarily increase or safeguard employment during the construction phase.

Indirect effects of energy infrastructure on employment are also important but difficult to be measured. Increase of energy production and supplying efficiency through modernisation of obsolete pouer plants, investments on small scale combined heat and power plants. modernisation and expansion of the distribution network will reduce the energy cost for industry and households. Reduction of energy cost for industry will decrease production cost and therefore increase competitiveness. which in turn could affect positively employment. Reduction of energ!. cost for households could create income multiplier effects.

Investments that increase energy efficiency in industry such as energ!. management systems. energy saving technologies, technologies that reduce or recover energ! loses through recycling/recovering of wastes, will reduce energy cost and increase competitiveness. Increase of competitiveness could in turn positively affect employment in investing firms and negatively in rival firms that fail to do so.

4.2.5. Effect of environmental technologies on employment

Protection of the environment is a promising area for creation of employment. Environmental services based on environmentally friendly infrastructures and technologies (e.g.water resources management: collection. treatment and recycling of industrial or municipal wastes: development and operation of systems for environmental monitoring. conservation of national heritage etc.) are significant sources of employment. During the construction of the infrastructures. temporary employment is created or safeguarded. The creation also of permanent employment is significant as provision of services. considering that operation and maintenance of the infrastructure can be labour intensive

In addition increasingly important are the employment opportunities offered in the environmental companies where the environment is a core part of their business. Eco-business. as their activities are called, include production and supplying of hardware, systems and services for the measurement. prevention and correction of damages to water, air and soil as well as activities for the reduction and treatment of wastes and noise[46].

According to the Helmet Kaiser Unternehmensberatung's (HKU) 1997 survey "The reorientation in the environmental technology industry", the environmental market is thought to be one of few major gronth industries over the nest 13 years. expecting to achieve within the period 1997 to

[46] See also COM(95) 509 final and Delphi International (1997)

2010 a growth rate of 46%. This estimation is close enough to the forecasts of an earlier study[47] of OECD conducted in 1992. According to this study the annual growth rate in real terms of the environmental technology industry is estimated at 5.5 per cent for the period 1990 to the year 2000.

4.2.6. Effect of transport technologies on employment

Transport technologies used by Structural Funds interventions affect employment directly by improving productivity and quality of service and indirectly by increasing the impact of transport to the regional economies.

New systems for transport management and ticket issuing (e.g. for rail. subways or public sur face transportation) based on information and communication technologies replace old labour intensive, time consuming and unreliable methods.

The increase of productivity and the new technology content of jobs leads to employment reduction and change in the composition jobs' skills. At the same time transport scheduling becomes more reliable and flexible and possibly reduces marginally journey times. At the same time. improvement on nagons. buses and other transportation equipment reduces drastically journey times, improve qualit)., and increases safety and therefore increase demand for public transport. which in turn increase employment.

Indirect effects on employment are also present. Improvements to transport facilities encourage economic development and regeneration, especially of remote areas, which in turn affects positively the creation of new jobs. Additionall!. improvements attract new investment and stimulate growth and tourism and improve physical access for unemployed to all job opportunities. Finally new temporary jobs are created during the construction phase,

4.2.7. Effect of technologies used in agriculture, forestry, fishery and rural development on employment

The following main categories of actions with technological content are used in agriculture and forestry, fishery and rural development:

- development of process and product innovations:
- energy saving actions:
- development of information and communication technology infrastructures and applications:
- infrastructure and services for the protection of the environment in rural areas
- R&D projects and infrastntctures.

Therefore. the effects on employment of the above type of actions are similar to those in the corresponding sections.

4.3 Impact of technology on equal opportunities between men and women

Contrary to the existed abundant bibliography relevant to effects of technolog!. on employment and sustainable development, bibliography on effects on equal opportunities between men and women is limited to some fragmentary references on the role of information technolog!,.

[47] OECD (1992)

In order the framework of analysis of impacts of technology on equal opportunities to be useful in the contest of Structural Funds. it should take into consideration that technologies used should reflect the need for convergence between the economic and social cohesion on the one hand and equal opportunities on the other. Under this perspective four areas of impacts seems to be more relevant[48]:

- living conditions which meet women's needs
- access to the job market
- **work** conditions
- participation by women in the creation of socio-economic activities

4.3.1. Effects on living conditions

Improvement of living conditions is one of the areas of intervention of Structural Funds under the Objectives 1, 2. 5b and 6 and includes improvements in the social and professional environment and within family. Interventions that contribute to the reconciliation of family with the social and professional activities are very important especially for women. In this category of actions the creation of a great number of neighbourhood services (e.g. medical care. child care, services for managing social and family problems) is included.

In this area where interpersonal contacts and relations are prevailing, technology is limited to applications such as:

- state of the art medical equipment that improve the quality of the medical senices:
- public transport systems which allow women in rural areas or in peripheral urban areas to have better access to these services.

4.3.2. Effects on women access to work

Interventions can also have effects on women access to work by reducing or even eliminating some of the access barriers which women face in the job market such as. discrimination at the hiring stage. lack of work experience. lack of qualifications or mothers which have to share their time between work and child care.

Information Society, with the development of suitable applications and services could provide opportunities for women to reduce some of the above barriers.

Information and communication technologies provide the opportunity for distant learning and lifelong learning allowing women and mothers to develop new skills by studding at home. Also new forms of employment are now feasible such as teleworking, which. in some cases. can contribute to and facilitate the reconciliation between work and family life.

4.3.3. Effects on the situation at work

Structural Funds interventions can contribute to the adoption of new work organisation which do not discriminate against women and improve the esisting organisation methods and work conditions in favour of both men and women.

Introduction of new technologies. which is frequently supported by Structural Funds. has controversial results in the division of work between men and women. As it has been pointed out in the conference "Employment 2002, the future for women" which took place in Linz. Austria on

[48] The classification is based on European Comnussion (1998f)

2-4 September 1998, women are under-represented in the field of new technologies. Also a division ofjobs and tasks between nomen and men in favour of the latter arises when new technology is first introduced into workplace. On the other hand diffusion of information technologies and automation control into the production system abolishes a division of labour based on muscular strength which was against women.

4.3.4. Effects on women's participation in socio-economic activities

Structural Funds intervention can contribute to increase opportunities for women to participate more actively in the economic sphere. Examples of actions supported by regional programmes are the creation of services to assist women to create their own business. such as consulting services, financial services etc.

Technology has a restricted role to play here. but infrastructures for innovation support including women in their target group, such as Innovation Centres described earlier in this stud!.. are important as they increase the opportunities for women to succeed in the economic sphere.

5 Indicators for Evaluation

5.1 Programme Indicators

Indicators provide quantified information in order to help identify and explain changes over time in relation to the objectives at each programming level as they are defined by the intervention logic of the Operational Programmes and Single Programming Documents[49]. To be able to estimate the **effectiveness** of a programme i.e. to compare what has been done with the originally planned outputs. results and impacts. a set of indicators are necessary which usually includes:

- ***Input*** indicators referring to the budget allocated to the different level of assistance i.e. measures, sub-programmes etc;
- ***Output*** indicators measured at the level of measures and represent the products of the operator's activity. They used for the assessment of the performance ate the level of operational objectives. They are measured in physical or monetary units:
- ***Result*** indicators related to the specific objectives and represent the programme's direct or immediate effects.
- ***Impact*** indicators which measure the performance of the programmes in relation to the general objectives, They also represent the consequences of the programme beyond the immediate effects on its direct beneficiaries. Impact indicators could measure either *specific* impacts which are effects directly linked to the action taken. or *general* impacts which are long-term effects affecting larger population. In the latter case the causality it is not always easy to be established.

An example of the characteristics of this indicators and their relation to the intervention logic of an intervention is presented in the following table.

	Description	Indicators
outputs	Building a natural gas energ! plant	• Physical: Kw of installed power • Financial: investment unit cost per kw
Results	• Increase of total energy production capacih • Decrease of energy cost	• % increase in kw produced • % decrease on cost/kw
Impact	• Decrease of dependence on fossil fuels • Effects on the environment Socio-economic effects	• Permanent employment generated • Changes in labour market • Improvement on balance of payment • Regional GDP per capita • reduction yearly consumption of fossil fuels • % reduction of emissions of CO_2.

Table 1 Example of Indicators Taxonomy

To be able to calculate most of the indicators. a comparison of the state in a selected point in time with the state before the beginning of the intervention is necessan'. For example in order to measure the percent reduction of emissions or the reduction in consumption of fossil fuels

[49] See chapter 2.1

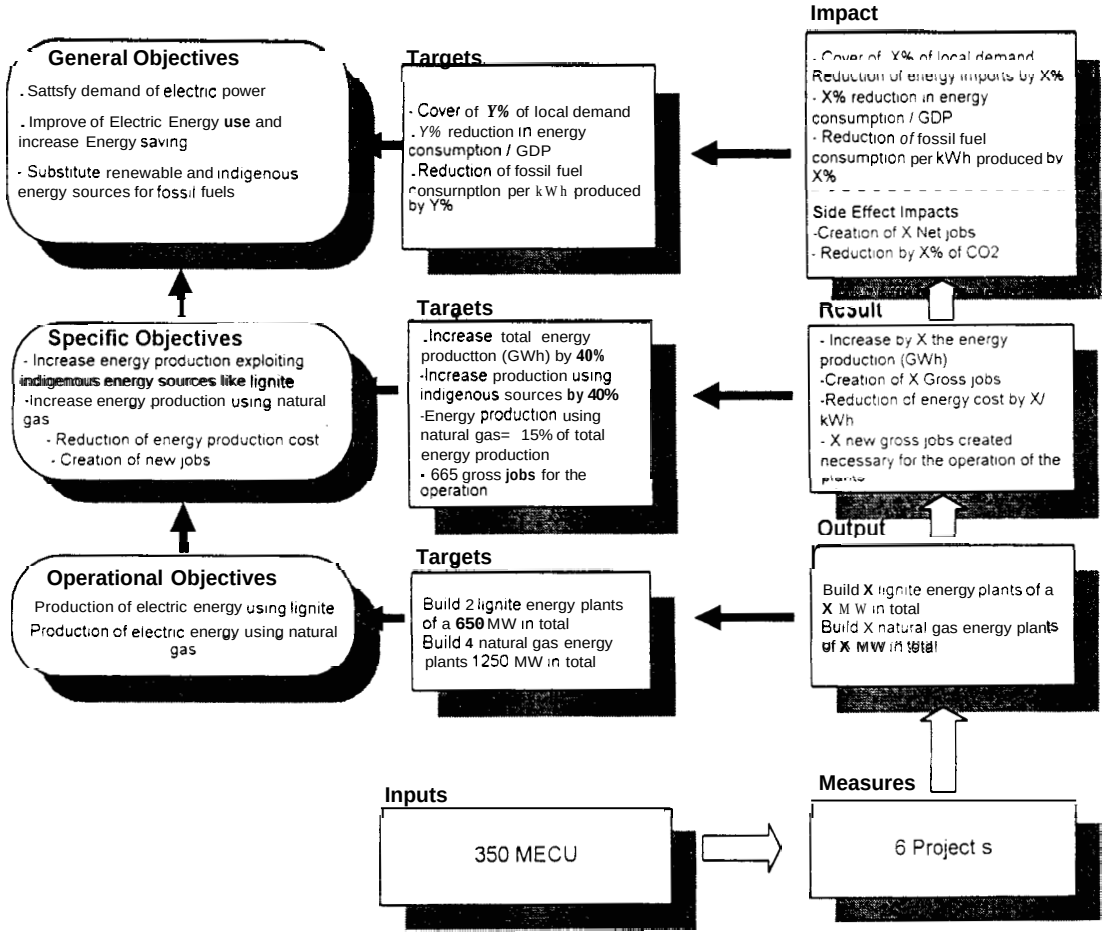
after the building of a natural gas plant, knowledge of the emissions and consumption before the building of the plant is necessan.. Consequently, a set of quantified baseline indicators that establish the status of the region at the start of the intervention should be created Obviously this set must be compatible with the set of indicators selected for the evaluation of the effectiveness and impacts of the intervention.

To be able to compare what has been done with what was originally planned. certain quantified targets should be established. The general and specific objectives should be quantified in terms of quantified impacts and results at the level of the programme and sub-programme respectively. Operational objectives should quantified in terms of quantified outputs at the level of measure.

In order the targets to be meaningful. indicators that are compatible with the baseline indicators should express them.

The relation between objectives, targets and programme outputs, results and impacts are presented in the following figure. As can be seen, general objectives are fulfilled when impacts reach the predefined targets. The gap between targets and actual impacts. results and outputs. or in other words the effectiveness of a programme. is measured comparing the values of relevant indicators.

Figure **4** Measuring the effectiveness and impacts of **a** Programme using indicators[50]



[50] The General Objectives have been based on the Greek Operational Programme "Energy". The specific objectives refer only to the Sub-programne 1 of the same Operational Programme. Accordingly. the Operational Objectives and the relevant targets refer to the measures of that Sub-programme.

5.2 Review of impact indicators

5.2.1. Review of indicators for the evaluation of impact on environment and sustainable development

Many indicators have been proposed and utilised for the assessment of the environmental impact. Studies have been carried out by many organisations and institutes in order to establish sets of suitable indicators to measure in a reliable and representative way the impacts of human activities[51] to the environment. In the interventions of the second Support Framework of EU, during the es-ante evaluation, implementation, monitoring and ex-post evaluation stages. many indicators have been proposed and used

In the following, indicators from recent studies of OECD and EUROSTAT are being presented. They are proposed to measure impacts at intervention and national level Most of these indicators can be used in a regional level depending the quality of the available data.

The OECD study[52] includes a core set of 50 environmental indicators as well as a set of sectoral (or socio-economic) indicators having environmental significance. These indicators are used in environmental performance reviews. They are suitable for national level (OECD countries) and for international level and cover issues that reflect the main environmental and sustainable development concerns in OECD countries. Given the national and international nature of these indicators not all are relevant for regions, These two sets of indicators are presented in brief in the following tables.

Table 2 The Core set of OECD Environmental Indicators

Environmental Concerns	Groups of indicators
Climate change	CO_2 emissions from energy use intensify Greenhouse Gases Concentration
Ozone layer depletion	Ozone depletion substances Stratospheric ozone levels
Air qualih	Air emission intensities Urban air qualih
Waste	Waste Generation Waste recycling
Water qualih	River quality Waste nater treatment
Water resources	Intensity of use of water resources Public water supply and price
Forest resources	Intensity of use of forest resources Forest and wooded land
Fish resources	Fish resources and consumption : National Fish catches and consumption: Global and regional
Biodiversih	Threatened species Protected areas

[51] Environmental Problems caused mainly from human activities

[52] OECD (1998a): Towards sustainable development: Environmental indicators

Table 3 The Set of OECD Socio- Economic indicators

Sector	Groups of indicators
GDP and population	Gross domestic product Population growth and density
Consumption	Private consumption Government consumption
Energy	Energy intensities Energy mis Energy prices
Transport	Road traffic and vehicle intensities Road infrastructures densities Road fuel prices and taxes
Agriculture	Intensity of use of nitrogen and phosphate fertilisers Livestock densities Intensity of use of pesticides
Espenditure	Pollution abatement and control expenditure Official development assistance

The EUROSTAT study". based on the methodology of the United Nations. propose 46 indicators for sustainable development suitable for the European Union. The indicators are categorised in four groups, which represent the four areas of interest (Economic, Social, Environmental and Institutional) and in baseline and performance indicators. The group of environmental indicators includes 21 indicators, which refer to air, water, soil, natural species, nature and wastes. The group of economic indicators includes indicators, which might be termed as environmental such as annual consumption of energy per capita. The list of environmental indicators proposed by EUROSTAT is presented belon.

Table 4 EUROSTAT Environmental **Indicators**

Sector	Indicators
Air	• Production and Consumption of CFC-I 1 and 12 • Emissions of Greenhouse Gasses • Total internal emission of CO_2 from fossil fuels (in Mio t. of CO_2) • Total internal emissions of CO_2 by sector (in Mio t. of CO:) • Reduction in internal emissions from fossil fuels • Sulphur oxides emission (CO: and SO_3) (kg of SO_x/per capita) • Nitrogen oxides (NO_x) emissions (emission of NO_2 in kg/per capita) • Expenditure on air pollution abatement
Water	• Consumption of water per capita (litters per capita per day) • Waste water treatment (population served by waste water treatment stations) • Annual withdrawals of ground and surface water (abstractions of ground and surface freshwater in % of the average annual volume of fresh water available)
Nature/resources	• Arable Land per Capita • Land use change

[53] European Commission (1998c)

Sector	Indicators
	• Energy use in Agriculture • Forest area changes[54] • Wood Harvesting Intensity • Management forest area ratio (% of public and private forest)
Soil	• Use of fertilisers in Agriculture • Use of Agricultural Pesticides
Wastes	• Generation of industrial and municipal solid waste • Expenditure on waste management • Rate of waste Recycling and Re-use
Natural species	• Threatened Species as a percentage of total Native Species • Protected Area as a percentage of total **Area**

5.2.2. Review of indicators for the evaluation of impact on employment

The analysis of Operational Programmes, Single Programming Documents. from various regions show that the evaluation of the contribution of actions with technological content, to the employment, is established on various versions of the next two categories of indicators:

- Indicators suitable for even. action and measure
  - the number of additional jobs created: and
  - the number of jobs safeguarded/protected/retained (i.e jobs existing which would have been lost if the project had not taken place).
- Indicators suitable for training actions and measures
  - upgrading of skills and improvement of employability; and
  - number of trainees that found job after six/twelve months the end of the training

In case of part-time jobs the indicators of the first category are expressed on Full Time Equivalent.

5.2.3. Review of indicators for the evaluation of equal opportunities

Indicators that most frequently used for the evaluation of Structural Funds interventions are limited to the quantification of women and men participation in the activities included in the intervention and the allocation of results between men and womene.g. number of men/women assisted. number of men/women who found job etc.

5.3 Criteria for selection of indicators

Indicators for use in evaluation should be selected during the Es-ante Evaluation Phase when the objectives are being established. Later during implementation the indicators should be revised in accordance with changes in the programme contest and design through consensus of the various stakeholders i.e. representatives of regional or national authorities and European Commission. who participate in the programme's Steering Committee.

The key criteria. which could be used in selecting indicators. are described bellow.

Indicators should:

[54] According to EUROSTAT. forest are land in which trees accounts for over 20% of vertical soil coverage

- be based on available data:
- be calculated at the measure level and reduced at the nest higher programming level;
- be representative;
- be scientifically valid:
- be simple and easy to interpret;
- show trends over time; and
- be sensitive at the changes of the factors it is set to measure.

5.4 Proposed indicators and evaluation criteria

5.4.1. Proposed indicators for the evaluation of impact on environment and sustainable development

The following indicators have been selected using the key criteria for selection of indicators. The number of indicators has been kept as small as possible and they are restricted to signal the impact of technologies or actions with technological content.

Table **5** Proposed indicators measuring technology's effects on systainable development and environmnet

Interventions with technological content	**Proposed Impact Indicators**
R&D	Effect on the environment of the research projects. • % change of air emissions • **Y**o change of wastes (solid and liquid) • *Y* change of noise level Effects from infrastructure projects are not measurable
Innovation and Technology transfer in Business	*Improvement in production system* Increase of number of Companies introducing Quality and Environment Assurance Systems (ISO 9000, ISO 1400. EMAS. TQM etc.) *Clean Technologies and Clean Production System* • Increase the number of plants using clean technologies • % of reduction of air emissions • % of reduction of wastes (solid and liquid) *Energy saving and Waste Minimisation technology* • % of energy saving • % of reduction of wastes
Information Society	• Number of applications for environmental management and protection • Number of applications for traffic management • Increase of the number of digital telephone line per 100 people
Energy Supply and production	*Better exploitation of Local Energy Sources* • Changes in exploitation range • % replacement of oil • % decrease of aerial emissions *Natural gas energy Plants* • % replacement of oil • % reduction of aerial emissions *Small Scale Combined Heat and Energy Plants* • % replacement of oil *Renewable Energy Plants* • % replacement of oil • % reduction of aerial emissions

Interventions with technological content	Proposed Impact Indicators
	• % reduction of exploitation rate of natural energy resources
Infrastructure for Protection and Promotion of Sustainable Development	• % reduction of wastes (aerial, solid, liquid) • % of waste recycled of the total • Increase of protected areas from degradation (erosion etc) • Increase of protected wildlife areas • Number of information technology applications for environmental management and protection
Transport	• % reduction of gases emitted by transport means (in urban areas) • % reduction of noise level in urban areas • % reduction of mean transportation time
Agriculture& Forestn	• % reduction or increase of energy use • % increase of product recycling • % reduction of wastes • % increase or reduction of fertilisers' use • % increase of use of alternative energy
Fishery	• % reduction or increase of fish stock exploitation rate • % reduction of waste production • % increase of waste treatment
Rural Development	• % increase of the area of organic farms • % increase or reduction of surface or ground water pollution from agriculture

5.4.2. Proposed indicators for the evaluation of impact on employment

The estimation of the impact of the projects on employment on a specific geographical area or social group is a difficult task as evidenced from the analysis in the chapter 3. However, the critical indicator in assessing the employment effects of the projects or interventions is to calculate the net **employment**[55] taking into consideration all possible interrzlations and opposite trends. Particularly the following issues should be taken into consideration during the calculation of the possible impact:

1. Calculation of employment at the level of a project gives the gross effects, which overestimate the number of jobs actually created or safeguarded. Starting from gross effects one should also consider the other effects presented in chapter 4 and are further codified bellow.
2. Special attention should be given in the **displacement**[56] effect that occurs when employment increases in one sector. or a firm, as a result of a project or intervention. at the expense of jobs in other sectors. or firms. For example a technology transfer project in an SME could allow the company to expand its market share and its employees by taking business from other rival firms and forcing them to reduce employment. These effects are very difficult to be identified and calculated especially when the displacement takes place in different sectors or locations.
3. The multiplier effects that result from the increase in income and subsequent increase in expenditure in the local economy from the net employment effects of the project or inter-

[55] For a further discussion on the issue of net employment see Commission Européenne (1997) and European Commission (1996).
[56] Ibid.

vention. Multiplier effects are practically impossible to quantify for individual regional interventions.

4. The **deadweight"** effect. that is employment that would have been experienced even in the absence of the project.

The net effect on employment or the net employment created by the project or intervention is estimated adding all the jobs created including the multiplier effects and subtracting the jobs lost or displaced and the deadweight according the following convention:

Net Effects = Gross effects − Displacement − Deadweights

All employment effects can be estimated for each main type of intervention with specific technological content following the analysis in chapter 3. **In** doing so, ancillary indicators have been determined and are presented in Table 6.

The employment effects should be estimated at the measure level. The physical outputs of the measures expressed by output indicators usually not directly related to employment (e.g. number of SMEs supported, number of Research Centres built) help to estimate the result on employment, namely the employment generated during or due the production of the outputs. The result indicators used for the calculation of employment at this level are presented in the 2nd column of Table 6. The rest of the indicators presented in the table are Impact Indicators.

This approach can be adapted to the needs of any particular intervention. measure or project and for different technologies.

Calculation of employment effects should distinguish clearly between full time and part time jobs. temporary and permanent, or between new/additional jobs and jobs safeguarded.

In order to smooth out the differences and present the effects in a comparable way. it is preferable to express all employment effects as **Full Time Equivalents (FTE)**

Apart from the "**key** employment" indicators it is often relevant to use *ad hoc* indicators in order to make a more in-depth analysis of impacts suitable to specific requirements of the evaluation.

The nay the indicators of employment effects are measured is depended on the scope of the measurement. Some methods are suitable for es-ante evaluation of interventions or selection of projects and others give better results when they used for es-post evaluations.

5.4.3. Proposed indicators for the evaluation of impact on equal Opportunities

Indicators suitable for the assessment of effects of technology or of actions with technological content on equal opportunities, or for gender impact assessment, should measure the improvement in eliminating the differences and inequalities between women and men in comparison with the situation prior the intervention.

Proposed indicators are classified into the main types of impacts presented in section 4.3. There is not a universal rule for constructing a system of indicators signalling the impact on equal opportunities. Therefore, the proposed set of indicators presented in Table 7 should be seen as a starting point of the effort to create a consistent set adapted to characteristics of specific intervention.

[57] Ibid

Table 6 Employment effects of various types of projects and measures

Type of Interventions	Implementation of intervention (Result Indicators)	Effects of Improvement in productivity (Impact Indicators)	Effects from new products and markets (Impact Indicators)	Indirect effects (Impact Indicators)		
				Flexibility of labour force	Effect on Suppliers	Other effects on local economy
Support for Infrastructure (Research centres, Telecommunications, Transport)	**Number of temporary new or retained jobs** during the construction and the operation of the infrastructure	**Number of jobs within the infrastructure that have been lost** due to increase of productivity in the operation of the infrastructure.	**Number of jobs created or retained** due to expansion of services offered by the infrastructure.		**Number of temporary jobs created or retained** due to increased demand during the implementation phase. **Number of permanent jobs created or retained** due to increase of demand during the operation of infrastructure	**Number of jobs lost** due to improvement of productivity for the users of infrastructure. **Number of new or retained jobs** due to increase in competitiveness and new product for the users of infrastructure **Displacement effects** **Income multiplier effects**
Support for the productive sector (Technology transfer projects in all sectors)	**Number of temporary new or retained jobs** during the project implementation	**Number of jobs lost** due to productivity increase. **Number of jobs created or retained** due to growth of the company	**Number of jobs created or retained** due to growth of the company		**Number of temporary jobs created or retained** due to increased demand during the implementation phase **Number of permanent jobs created or retained** due to the increase of demand during the operation of the SME	**Displacement effects** **Income multiplier effects**
Specific training measures	**Number of temporary new or retained jobs** for trainers during the implementation	**Number of jobs lost** due to productivity increase. **Number of jobs created or retained** due to growth of the company	**Number of jobs created or retained** due to growth of the company	**Number of skills upgraded or acquired.** **Number of unemployed trainees who found job** six months after the training.	**Number of jobs created or retained** due to increase of demand for training tools.	**Displacement effects** **Income multiplier effects**

Table 7 Proposed indicators for the evaluation of impact on equal opportunities

Type of Impact	Sector	Indicator[58]
Living conditions	Transport	▪ Number and type of services accessed by women living in a certain area within 10, 15 and 30 minutes. ▪ Increase of frequency of local public transport.
Access to the job market	Information Society and Human Resources	▪ Number of beneficiaries of distance learning, broken down into men/women (result). Employment rate of beneficiaries 12 months after the training, broken down into men/women. ▪ Number of beneficiaries of teleworking facilities and infrastructure, broken down into men/women (result). ▪ Employment rate of beneficiaries with access to teleworking facilities, broken down into men/women.
Situation at work	Innovation, Technology transfer and productive investments in business	▪ Percentage of female beneficiaries employed within male-dominated sectors (result). ▪ Percentage of male beneficiaries employed within male-dominated sectors (result). ▪ Change in men/women ratio in business/sector assisted. ▪ Percentage of beneficiaries of the measure who have become senior executives, broken down into men/women.
Participation in the creation of economic activity	Innovation, Technology transfer and productive investments in business	▪ Number of services explicitly including women in their target group (result). ▪ Number of beneficiaries of aid in the area of innovative economic activity, broken down into men/women (result). ▪ % of SMEs assisted by the programme which are run by men/women (result). ▪ Success rate of business set up by aid beneficiaries after two years of activity, broken down into men/women.

[58] **All** indicators are impact indicators unless otherwise indicated in parenthesis e.g. (result). For definitions for impact and result indicators see section 5.1

6 Ex-ante evaluation of programmes and selection of projects

6.1 Ex-ante evaluation

Ex-ante evaluation of the overall Plan, Operational Programme or Single Programming Document assesses whether the intervention is an appropriate means for addressing the issues confronting a region or a sector. Additionally evaluation assesses whether the intervention has well defined strategic axis, priorities and objectives and whether it contributes to social and economic cohesion and to other National and EU policy objectives. Moreover, es-ante evaluation sets the basis for both monitoring and es-post evaluation of the effectiveness and impacts of the intervention. Finally es-ante evaluation sets the framework for the design of project selection procedures and criteria.

European Commission has recently published a guide". which highlights the main issues that should be covered by an es-ante evaluation. The guide codifies the experience gained from the ex-ante evaluation of interventions financed by Structural Funds during the two programming periods and therefore it should constitute the starting point of any methodological improvement.

In the present study we are examining those parameters and prerequisites necessary for improving the assessment of the consistency of regional interventions with the European Union policies on environment and sustainable development. employment and equal opportunities between men and women. Issues such as the appraisal of the management and monitoring mechanisms are very important. but will not be included. since there are not within the focus of the stud!,.

The starting point of an es-ante evaluation is the analysis of strengths, weaknesses. opportunities and threats (SWOT) of the Member State. region or sector. The SWOT analysis give rise the real needs and socio-economic problems that should be addressed by the interv ention and in this way determines its strategic axis and priorities. Therefore it is essential that the needs of sustainable development. the safeguarding or creation of new jobs and the promotion of equal opportunities should be taken into consideration and should be part of the analysis parameters at this initial point.

SWOT analysis should result in a comparable set of baseline indicators used during the implementation procedure for the monitoring of the progress achieved and for the final ex-post evaluation of the intervention.

As soon as the main needs and socio-economic problems have been identified the es-ante evaluation should help in assessing the justification of the choice of priorities that has been made and the proposed policy mis.

The assessment is a top-down process (from the general to the specific). The justification of the strategy has to be made first at the level of the global objectives. At that level objectives should not only include the social and economic cohesion objectives of the Structural Funds. but they should also conform to the National and Community policies and priorities including the sustainable development. employment and equal opportunities. Each priorit!. should be assessed in terms of its contribution to these overall objectives.

[59] European Commission (1998e)

Proceeding to the nest step. es-ante evaluation should provide an appraisal of the consistency between global objectives on one hand and the specific objectives served by the priorities or sub-programmes, on the other. The appraisal should go down to the level of measures where the global and specific priorities are being implemented assessing the consistency between the specific objectives and the operational objectives defined at the level of measure.

At this point the quantification of the objectives is crucial. Care should be taken upon two issues. Firstly, the evaluation process should help planning authorities to identify and agree upon a set of relevant indicators, following the analysis of Chapter 5 of this study, suitable for the quantification of the:

- impact at the level of global objectives;
- results at the level of specific objectives; and
- outputs at the level of operational objectives.

Secondly, the various levels of objectives i.e. general, specific and operational. should be quantified setting specific targets by using the selected set of indicators. Targets should express the desired change with regard to the situation before the intervention, illustrated by the baseline set of indicators.

Also, at this point the es ante evaluation should give an insight on the reliability of the quantification procedure as well as on the estent to which the intervention can be evaluated.

Finally, the es ante evaluation should address the question of the impacts and results to be anticipated estimating the extend to tvhich they will contribute to the achievement of the general and specific objectives. The European Commission has proposed[m] different levels of impact analysis. These levels are regarded as suitable to the objectives of the present study and therefore are adopted as a starting point. The rationing is that es-ante evaluation should assess the contribution of the intervention to the achievement of the following objectives:

1. General Social and Economic Cohesion objectives. Three variables are the most important since they are the building blocks of cohesion analysis. namely the GDP of the concerned region. the employment and the productivity.
2. Objectives related to the specific intervention that take into consideration the scope of the intenention for each Structural Fund (Objective 1. 2. 3. 4. 5a. 5b and 6)
3. Main **EU** policies such as the impact on the environment and sustainable development and on equal opportunities.

In addition to the Commission recommendations and the practices of Member States. an assessment of the utilisation of technology should be introduced as an integrate part of the impact evaluation at the level of measure. As it has been argued in chapter 4. utilisation of technology can support or undermine the efforts for sustainable development, increase of employment and equal opportunities. Therefore, it is crucial to assess the way technology is incorporated into regional interventions and the expected impact as well. This appraisal should be completed at the beginning of the intervention's life cycle. before Operational Programmzs and Single Programming Documents are agreed by Member States and European Commission.

It is obvious that the evaluation of possible impacts should not be restricted to the issues above mentioned but should also cover countn and regional specific needs,

[60] Ibid

Analysing the previously obtained evaluation results can provide valuable insight for all the steps of an ex ante evaluation. Information acquired can support judgements on the relevance of aims with objectives. the effectiveness of policies or the difficulties in implementation. Also existing evaluations often contain data for the estimation of various indicators mainly relevant to outputs and some times relevants to results.

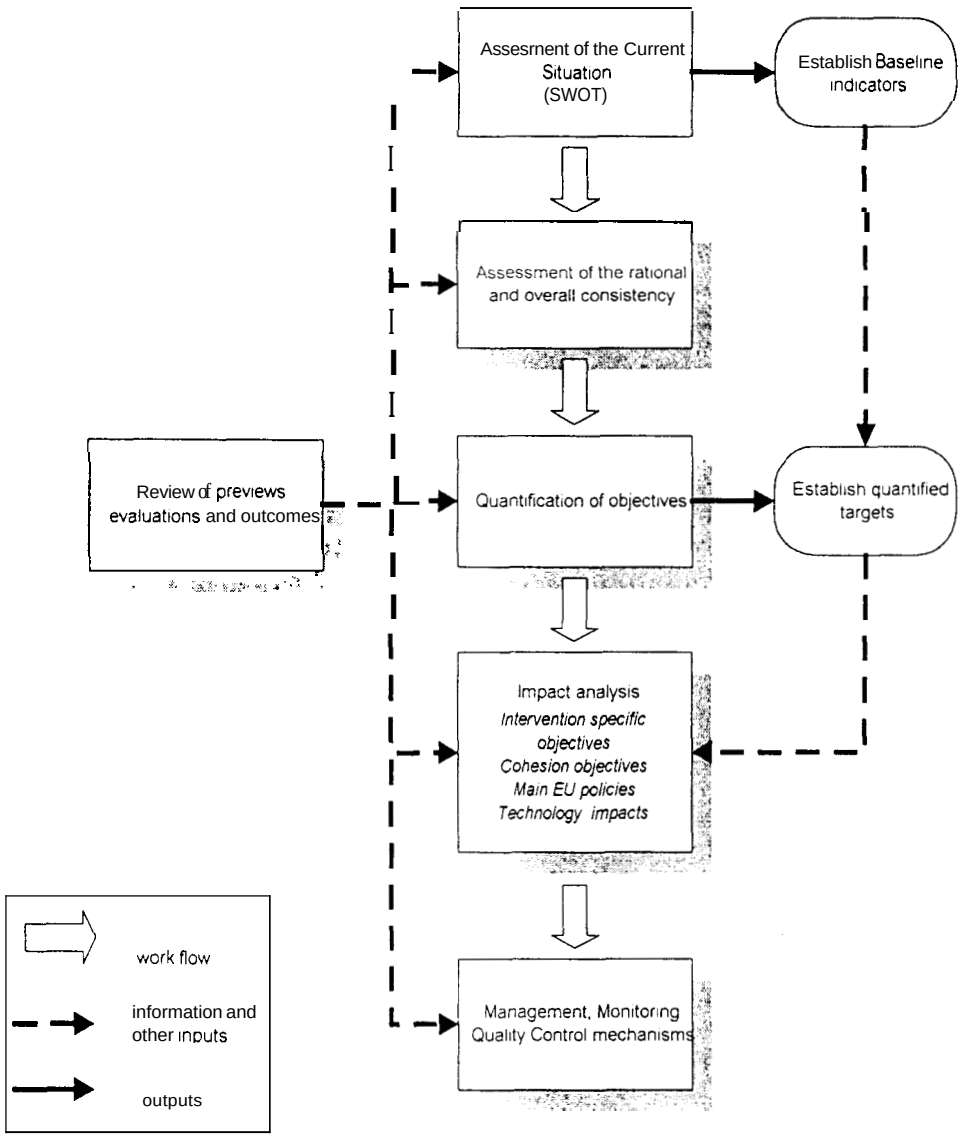


Figure **5** Components **of** an ex-ante evaluation

An overview of the components of an es-ante evaluation is illustrated in Figure 5.
The process described above needs to be further enhanced in order to cope with the requirements of sustainable development, increase of employment and promotion of equal opportunities.

6.1.1. Methodological issues for the ex-ante evaluation of effects on sustainable development and environment

The objective of sustainable development must be integrated within the intervention's objectives at an early stage of the intervention's lifecycle and specifically at the stage of the preparation of Regional Development Plans. **At** a latter stage the objective should be further specified and in-

tegrated in the global, specific and operational objectives of the Operational Programmes or Single Programming Documents.

The scope of the various stages of the es-ante evaluation varies from broad and general in Regional Development Plans to narrow and specific in Operational Programmes and Single Programming Documents.

In the following sections, some of the ex-ante evaluation stages will be further discussed in order to clarify certain issues that need specific attention.

6.1.1.1 Assessment of the environmental situation

The assessment of a Regional Development Plan should provide an environmental profile of the specific region concerned, including an analysis of the strengths, weaknesses. opportunities and threats (SWOT) to sustainable development as well as environmental and socio-economic baseline indicators according the Table 8.

Table 8 Indicative list of General Baseline Indicators for the Environment and Sustainable Development

Key Criteria	Baseline Indicators
Air and climate change	• Air quality levels: • Sulphur dioxide levels; • Carbon dioxide emissions
Protected Areas:	• Area (ha) covered by national or international nature consenation designations (eg Natura 2000 - Special Area of Conservation and Special Protection Areas-. Ramsar Sites. Biogenetic Reserves): • Area (ha) of regional of local importance for habitats and/or species protection. which are not designated as protected areas: • List of threatened species (red data species: species listed in the annexes of Directives EC/92/43 and EC/79/409; species listed in national Biodiversity Strategies - Convention on Biological Diversity) • List of endemic species
Natural resources: Water	• River and groundwater quality levels: • Estuary and coastal water qualih levels; • Waste water treatment infrastructure • Water Balance Rates • Water consumption levels (domestic and industrial) • Imgated surface area • Abstraction Rates (Surface and Groundwater)
Natural resources: Land	• Type and distribution of land uses (urban. industrial-minerals-derelict land. agriculture. forest?. nature conservation. open water. open land) • Amount (ha) of high quality soil: • Amount (ha) of green areas around urban centres: • Amount (ha) of derelict land: • Amount (ha) of contaminated land: • Amount (ha) of public open space; • Amount (ha) of forested area
Landscape	• Area (ha) covered by national landscape designations (eg National Parks. Natura 2000 sites): • Area (ha) covered by local landscape designations in (eg Community Forests. Arens of Special Landscape value)

Key Criteria	Baseline Indicators
Noise	• Proportion of population to levels between 55-65 Leq dB(A). and to less than 55 Leq dB(A) • Total surface area which is 4 km or more distant fonn settlements and transport infrastructure
Coastal zones	• Water quality (including euuophication); • Erosion trends: • Areas potentially affected by sea level rise: • Estent of protected areas: • Estent of habitats at risk • Risk of major accidents (eg from navigation)

Source: European Conunission (1998a), 'Table 1.2

The SWOT analysis and baseline set of indicators of individual Operational Programmes and Single Programming Documents should be specific to the particular development objectives and the economic sectors where the programmes under consideration are intended to intervene. Indicative sets of baseline indicators suitable for specific sectors are presented in Table 9

Table 9 Indicative Specific Baseline Sustainable Development Indicators for actions with technological content

Interventions with technological content	Indicative Impact Indicators
R&D and Innovation	No specific indicators are required
Technology transfer and Productive Investment in Business	*Improvement in production system* Number of Companies introducing Qualih and Environment Assurance Systems (ISO 9000. ISO 1400. EMAS. TQM etc.) *Clean Technologies and ('lean Production Systems* • Number of plants using clean technologies • Air qualih levels: • Sulphur dioxide levels; • Carbon dioxide levels; • Amount of commercial and industrial waste production: • Water consumption levels (domestic and industrial): • % of population exposed to levels between 55-65 Leq dB(A). and to less than 55 Leq dB(A)Air emissions: • % of reduction of wastes (solid and liquid): • Amount (ha) of contaminated land: • Amount (ha) of public open space: *Energy saving and Waste Minimisation technology* • Total energy consumption • Energy consumption by sector
Information Society	*Datn transmission Applications* Number of applications for environmental management and protection
Energy Supply and production	• Total energy consumption • Energy consumption by sector • Air qualih levels: • Consumption of fossil fuels • Exploitation rate of natural energy resources • Energy use efficiency • Energy production from national resources

Interventions with technological content	Indicative Impact Indicators
	• Amount of energ! from natural gas • Amount of energ produced by small scale combined heat and energy plants • Amount of energy from renewable and non-renewable resources
Infrastructure for Protection and Promotion of Sustainable Development	• List of general baseline indicators, see Table 8 • Number of information technology applications for environmental management and protection
Transport	• Gases emitted by transport means (in urban areas) • Noise level in urban areas • Share of passenger travel by road. rail. air • Share of passenger travel in urban areas (by transportation mean) • Share of freight traffic cames by road. rail, inland waterways • Mean transportation time in routes included in the intenention
Agriculture & Forestry	• Energy use in the sectors • Level of product recycling • Natural resources. see Table 8 • Landscape. see Table 8 • Levels of fertilisers' use • Use of alternative energy resources
Fishery	• Fish stocks • fish stock exploitation rate • waste production from fishery activities (e.g. aquaculture) • Treatment of wastes (e.g. aquaculture wastes)
Rural Development	• Natural resources. see Table 8 • Landscape. see Table 8 • Surface or ground water pollution from agriculture • Number and area of organic farms

Indicators proposed in Table 8 and Table 9 are indicative and should be used as guidance. It's impossible to foreseen all type of interventions that could be supported by Structural Funds in order to include beforehand relevant baseline indicators. So when specific Operational programmes or Single Programming Documents are planned the above lists should be adapted to the particular objectives and particularities of the intervention under question

6.1.1.2 Assessment of the environmental consistency of the strategy

The development strategy follon-ed in Regional Development Plans and Programmes should be consistent with the EU policy objectives to promote sustainable development and a high level of protection and improvement of the quality of the environment. Moreover. priorities and specific measures should be consistent with the European Union environmental legislation. The Table 10. based on a handbook on environmental assessment[61] prepared by European Commission, DG XI. gives ten sustainability criteria which can be used as a check list in order to assess the consistency of the programme objectives (global. specific and operational) with the EU policy and legislation.

[61] European Comnussion (1998a)

Table 10 Sectors of Intervention and the relevant key sustainability criteria and EU legislation

Taxonomy of Structural Funds Interventions	Key Sustainability Criteria	Key EU environmental legislation)
R&D and Innovation Technology Transfer and Productive Investments in Business Energy Transport	Minimise use of non-renewable resources	85/337/EEC (97/11/EC)-EIA 91/156/EEC -waste 91/689/EEC -hazardous waste
R&D and Innovation Energy Agriculture and Forestry Fishery Rural Development Infrastructure for Protection and promotion of Sustainable Development Transport Technology Transfer and Productive Investments in Business	Use renewable resources within limits of regeneration capacity	85/337/EEC (97/11/EC)-EIA 91/156/EEC -waste 91/689/EEC -hazardous waste 91/676/EEC - nitrates 92/43/EEC - habitats and species 79/409/EEC -birds
R&D and Innovation Technology Transfer and Productive Investments in Business Energy Agriculture and Forestry Rural Development Fishery Infrastructure for Protection and promotion of Sustainable Development Information society	Environmentally sound use and management of hazardous/polluting substances and wastes	85/337/EEC (97/11/EC)-EIA 91/156/EEC -waste 91/689/EEC -hazardous waste 96/61/EC-IPPC
Infrastructure for Protection and promotion of Sustainable Development Technology Transfer and Productive Investments in Business Agriculture and Forestry Fishery Rural Development Transport Energy	Conserve and enhance the status of wildlife. habitats and landscapes	92/43/EEC - habitats and species 79/409/EEC - birds 85/337/EEC (97/11/EC)-EIA 91/676/EEC - nitrates
Agriculture and Forestry Rural Development Infrastructure for Protection and promotion of Sustainable Development R&D and Innovation Technology Transfer and Productive Investments in Business	Maintain and improve the quality of soils and nater resources	85/337/EEC (97/11/EC)-EIA 91/676/EEC - nitrates 91/156/EEC -waste 91/689/EEC -hazardous waste 91/271/EEC -urban waste water
Infrastructure for Protection and promotion of Sustainable Development	Maintain and improve the quality of historic	85/337/EEC (97/11/EC)-EIA

Taxonomy of Structural Funds Interventions	'Key Sustainability Criteria	Key EU environmental legislation)
Technolog) Transfer and Productive Investments in Business . Information society Transport	and cultural resources	
Infrastructure for Protection and promotion of Sustainable Development Technology Transfer and Productive Investments in Business R&D and Innovation Information society Transport Rural Development Energy Information Society	Maintain and improve local environmental qualih	85/337/EEC (97/11/EC)-EIA 91/156/EEC -waste 91/689/EEC -hazardous waste 91/271/EEC -urban waste water 96/61/EC-IPPC
Transport Energy Technology Transfer and Productive Investments in Business	Protection of the atmosphere	85/337/EEC (97/11/EC)-EIA 96/61/EC-IPPC
R&D and Innovation Infrastructure for Protection and promotion of Sustainable Development Information Society	Develop environmental awareness. education and training	
All categories	Promote public participation in decisions invoking sustainable development	85/337/EEC (97/11/EC)-EIA 96161/EC-IPPC

Source: Adaptation from European Commission (1998a), Table 3.2

The above key criteria should be further analysed and specialised creating a set of checklists for each sector and category of intervention.

6.1.1.3 Assessment of impact on sustainable development and quality of environment

The impact of interventions on sustainable development and quality of the entironment of the supported regions should be assessed taking into consideration the following types of impacts.

- **Direct impacts:** These are the directs effect of measures on the quality of the environment and natural resources:
- **Indirect impacts:** These are usually the long term results of measures e.g economic development in an area without sufficient railway facilities will result to an increase of freight traffic carried by road. which in its turn leads to an increase of consumption of fossil fuels. of gaseous emissions and of noise levels:
- **Impacts generated by multiplier effects[62]:** Development caused by the intervention trigger further development which in its turn affects the environment and sustainable development:

[62] This type of impacts are referred also as seconda? impacts. see European Commission (1998a)

- **Impact interactions and cumulative effects:** Interaction of impacts or the accumulation of incremental impacts from previous, present or future measures and programmes could cause significant effects of similar or different kind to the initial impacts.

The above programme implications can be assessed using various techniques, which are similar to those used for the ex-post evaluation.

It is relatively easy to predict direct effects at the level of measure as long as it is known the precise activities or type of projects that are included in the measures and the location that these activities will take place. However. this is not always the case as in a number of measures (e.g. support to industry or R&D measures) that the final beneficiaries and the content of their projects become known only during the implementation. In general the prediction of other type of impacts and the overall impact at the programme level is far more complicated and involves additional uncertainties such as:

- scientific uncertainties and lack of knowledge:
- lack of precision in measuring the impact:
- low quality of existing environmental statistics;
- in some cases geographical areas affected by interventions are not compatible with the division followed by environmental statistics.

Additionally to the above, lack of planning experience from the part of regional authorities leads to a design of interventions (grouping of projects under measures, division of priorities and subprograms into measures) that does not facilitate the estimation of impacts at higher levels using information collected at the measure level (bottom-up approach).

6.1.2. Methodological issues for the ex-ante evaluation of employment effects

Additional to the general methodological issues of es ante evaluation covered in the beginning of the chapter the following issues should be stressed regarding the es ante evaluation of employment effects.

In order for the conclusions extracted from evaluation procedure to be meaningful. **net employment** effects must be estimated deducting the displacement and deadweight effects from the gross ones. according the analysis presented in section 5.4.2.

The estimates should be deducted by measure and priority or subprogram and should be verifiable at the interim and final evaluation stages. As the estimation is complicated it is important that the methods used are transparent and explicit presenting clearly all the assumptions used.

Results and experience gained from previous programming periods are vital and should be fully exploited. Additionally. the various existing studies on measuring employment effects generated by European Commission should be used".

The overall analysis of section 4.2 and 5.4.2 and the indicators presented in Table 6 can make easier the estimation of employment effects.

A bottom-up approach i.e. the estimation of impacts at the level of measurzs. should be a starting point because of a number of advantages. The most important is the fact that the contribution of the individual components of the programme can be clearly identified and therefore the assess-

[63] For example the **MEANS** Handbook No 3 "Measuring the employment effects of Community Structural Funds. or Commission Européenne (1997) and European Commission (1996).

ment of the effectiveness and efficiency is feasible. Another advantage is that this approach can make use of esperience of previous programmes.

Following this approach the effects on employment during the implementation of the intervention and the effects on productivity improvements, in addition to the effects on the creation of new products and the opening to new markets presented in the second, third and to fourth column of Table 6, can be estimated,

Indirect effects described in the remaining part of Table 6 cannot be estimated using the bottom-up approach and their calculation should be based on previous experience. survey, research work or macro-economic models.

Progress has been made in the es-ante evaluation of employment for the current programming period (1997-99) of Single Programming Documents. The persistence and guidance of the European Commission provided detailed estimates of the jobs created or safeguarded as a result of the intervention at the measure level in 55 SPDs[64] corresponding to approximately 66% of the total EU funding. The methodolog!. used for the estimation needs to be further improved does not take account of deadweight and displacements effects but refers only to the gross number of jobs. Exception was some UK and French SPDs which provided estimates of net job creation.

6.1.3. Methodological issuesfor the ex-ante evaluation of effects on equal opportunities

There is no standardised method on equal opportunities assessment. The European Commission, DG XVI has initiated an effort to approach the issue preparing a methodological proposal[65] covering both types of evaluation **ex** *ante* as well es *post*. Also DG V has prepared a "Guide to gender impact assessment". However, none of these documents takes into consideration the use of technology that is of importance in any evaluation exercise.

The gender and equality evaluation should be taken into account in all policies and activities according the mainstreaming commitment taken in the Treaty of Amsterdam (Articles 2 and 3). Even policies which appear gender neutral may on closer investigation turn out to affect women and men different. Therefore it is vital to consider the issue of equality in the early stages of the "life cycle" of every intervention.

6.1.3.1 Assessment of the situation in terms of equality

Preferably the starting point of the es-ante evaluation should be the Regional Development Plan beginning with an assessment of the situation in terms of equality accordiny the general methodology presented in the first part of this chapter. This first appraisal should describe the situation in terms of equality, the specific constraints for every concerned group. as well as the results of the measures taken in the previous programming period.

Also a set of baseline indicators should be prepared including among others

- availability of social infrastructure.
- breakdown of long- term unemployed by ses,
- female activity rates,
- proportion of women by social and professional category

[64] European Comnussion (1997f). "The Structural Funds in 1996: 8th annual report"
[65] European Comnussion (1998f)

The appraisal should also be included in the Operational Programmes and Single Programming Documents which follow the Regional Development Plan but by now it should focus on the specific area of intervention.

Similarly the set of Baseline indicators should be specific to the characteristics of the sector and area of intervention. Due to the orientation of the present study towards technology effects we have limited the proposed set of baseline indicators to sectors and areas of intervention where technology can play a role regarding the equal opportunities.

Table 11 Proposed baseline indicators *for* the evaluation of impact on equal opportunities

Type of Impact	Sector	Indicator
Living conditions	Transport	• Number and hpc of services accessed by women living in a certain area within 10. 15 and 30 minutes. • Frequency of local public transport.
Access to the job market	Information Society or Human Resources	• Male and female unemployment (long-term. young unemployed) rate within the region. • Employment by sector and gender in the region • Existing facilities and infrastructure that can support teleworking.
Situation at work	Innovation. Teclmology transfer and productive investments in business	• Percentage of female beneficiaries employed within male-dominated sectors. • Percentage of male beneficiaries employed within male-dominated sectors. • Men/women ratio in business/sector assisted. • Percentage of senior executives by sector and activity. broken down into men/women.
Participation in the creation of economic activih	Innovation, Teclmology transfer and productive investments in business	• Number of esisting services explicitly including women in their target group. • Percentage of SMEs run by men/women • Percentage of new business which have been set up by men/women.

6.1.3.2 Assessment of the consistency of the strategy in terms of gender equality

At this stage of evaluation the following questions should be answered[66]:

- What does the gender perspective mean in connection with the basic function and principles of EU cohesion policy?
- What are the interests of men and women related to the strategy, priorities and measures of the specific intervention?
- What are the direct and indirect target groups of measures'?
- What are the barriers for women and men to participate in the intervention"

6.1.3.3 Assessment of impact on equal opportunities

At this stage the evaluation of possible impacts on equal opportunities should be implemented focusing on the measures of the programme. For doing so. measures should be classified ac-

[66] See also Horelli. Lisa (1996)

cording their impact into the four types presented earlier: Living conditions; Access to the job market; Situation within work and Participation in the creation of new activities.

6.2 Methodological issues for project selection procedures

6.2.1. Review of criteria usedfor project selection in Structural Funds Interventions

6.2.1.1 Review of criteria related to sustainable development and environment

At the level of project selection there are statutory evaluation procedures like the Environmental Impact Assessment (EIA) (Directive 97/11/EC[67] amending Directive 85/337/EEC) and a set of legislation and regulations at national or Community level that shape a framework for environmental protection. An example of key environmental legislation and its relation to the typical range Structural Funds Interventions is presented in the following table.

Table 12 Key environmental legislation used for the selection of projects

Actions of Structural Funds	Key Environmental Directives
Rails	ELA (85/337/EEC and 97/11/EC) Birds (79/409/EEC) Habitats (92/43/EEC)
Other public transport	EIA (85/337/EEC and 97/11/EC)
Water Supply - Storage , distribution, and treatment	EIA (85/337/EEC and 97/11/EC) Habitats (92/43/EEC) Drinking water (80/778/EEC) Nitrates (91/676/EEC)
Waste water collection and treatment	EL4 (85/337/EEC and 97/11/EC) Birds (79/409/EEC) Habitats (92/43/EEC) Urban wastewater (Y1/2271/EEC)
Municipal waste management & hazardous waste management	EIA (85/337/EEC and 97/11/EC) Waste & hazardous waste (91/156/EEC and 91/686/EEC)
Industrial Sites and treatment of contaminated land	IPPC (96/61/EC) EL4 (85/337/EEC and 97/1 LEC) Dangerous Substances (67/548/EEC) Hazardous waste (91/689/EEC)
Control of farmyard pollution	Nitrates (91/676/EEC) Dangerous Substances (67/548/EEC)
Agro-turism, SMEs development, farm diversification schemes	ELA (85/337/EEC and 97/11/EC) Habitats (92/43/EEC) IPPC (96/61/EC)
Aquaculture, development, afforestation, biomass	ELA (85/337/EEC and 97/11/EC) Birds (79/409/EEC) Habitats (92/43/EEC)

Source: European Commission (1998a)

The projects candidate for fùnding. before the final approval from the Monitoring Committee. have to qualify the EIA process. In addition. the appropriate authorities must have approved the environmental terms of the project. Environmental terms secure the compliance with relevant regional, national and Community Environmental legislation.

According to the implementation of Directive 85/337/EEC in all Member States[68]. projects that have to pass the EIA procedure are grouped in different categories with small modifications

67 OJ L73, 14.3.97

68 European Conmission (1993b). Report from the Commission of the Implementation of Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment

among Member States, according to the size of the project and the magnitude of environmental hazards they may cause and according to their economic and industrial activity. Brief summary of this categorisation is presented in Table 13.

Table 13 Categories **of** projects the **EIA** directive applies

Categories		Projects
Category A	**Group A**	Refineries; thennoelectric power station and other combustion units with minimum thermal power capacity of 300MW; nuclear station and nuclear reactants: installations of storage and final disposal of radioactive wastes; integrated iron and steel Industries; mining installations of asbestos and asbestos processing Industries. integrated chemical industries; highways and railways projects: airports; commercial ports; canals and ports of internal navigation; installations of toxic wastes disposal with incineration: chemical processing or disposal in the soil.
	Group B	Agriculture: mining industries; non metal industries; energy production industries (those not included in Group A). metallurgy industry; glass industry; chemical industries (excluding those of Group A); food Industries. textile; leather; wood and paper Industries, infrastructure projects; other projects
Category B		This category includes projects and activities that not appear in category **A** and license for operation is required according to valid legislation

The **EIA** methodology has been criticised as inadequate[69] leaving aside the need for economic and environmental sustainability. The main weak points of the **EIA** procedure are[70]:

- inability to determine the relevance of impacts, in particular of cumulative or synergetic impacts of small projects:
- lack of a simple. effective and consistent screening procedure: and
- limited sensitivity of the screening procedure and methodology with respect to the particular environmental conditions.

In cases where projects are excluded from the **EIA** due to their size or their content alternative criteria are used. The most common of them are presented by type of action in the following table.

Table 14 Project selection criteria used by type **of** action

Actions	Criteria
R&D	In this type of projects selection criteria rarely refer to protection of the environment.
Innovation and Technology transfer and productive investments in business	• Environmental protection • Additionally, environmental impact assessments are required for all projects, which are likely to have significant environmental effects, according the EC Directive 85/337/EC.
Information Society	No criteria
Energy Supply and production	*General criteria* • Contribution to generation diversity and security in the energy production; • Annual saving of primary conventional energy • Improved efficiency in energy consumption; • Improvement of the environment. Contribution of the project in the reduction of CO_2 and other gaseous emissions according the EU emissions levels; • Other environmental impacts *Criteria for projects aiming at the increase of energy efficiency* • Reduction of energy consumption. All projects should demonstrate an ability to lead to a reduction in energy production in a specific location or to contribute to measurable im-

[69] European Parliament (1996). **European** Commission (1997a), COM (95) final

[70] **European** Commission (1997a)

Table 14 Project selection criteria used by type of action

Actions	criteria
	provements in the efficient use of energy in the economy as a whole e g number of tones of CO_2 saved annually. • Energy cost and consumption savings in assisted firms ***Criteria for renewable energy projects*** Environmental impacts like: • impacts from the transfer of biomass; • contamination from toxic emissions from geothermal system: • pollution from solid or liquid wastes; • sound vexation e.g. in cases of wind generators. • Aesthetic falloff. *[A good example of selection **criteria** used is the **Greek** Operational Programme of Energy for Objective 1]*
Infrastructure for the protection of the environment and promotion of sustainable development	Selected projects should prove. • conformity with Community Environmental regulations according to the result of the Environmental Impact Assessment • long-term environmental effects
Transport	**All** transport projects, which are likely to have significant environmental effects. must be the subject of an environmental impact assessment according to the requirement of EC Directive 85/337/EC and national legislation. Also prior to funding, due account should be taken of the nature conservation objectives of Directive 79/409/EEC on the conservation of wild birds and Directive 92/43/EEC on the conservation of natural habitats Account should also be taken of commitments of the Community and the specific Member State to safeguarding species and avoiding or minimising any deterioration of important natural habitats intended to be protected by the Convention on the conservation of European wildlife and natural habitats.
Agriculture and Forestry	Projects should be consistent with the specific criteria imposed by the regulation relevant to the specific action (e g. selection criteria set out in the annex to Decision 94/173/EC for actions funded under 866/90). Additionally selection criteria include the requirement that projects should conform with: • the health and plant health rules; • the Community rules on the quality of agricultural products and foodstuff. • National and European Community environmental legislation. *[A good example of selection criteria used are those in the Finland and Swedish SPDs for Objective 6*[1]*.*
Fisheries	When selecting which project to be supported, conformity with the sustainability priorities criteria of the Common Fishery Policy is required. In particular projects are initially subject to the specific provisions fixed by Council Regulation (EEC) No 2080/93 of July 1993, laying down provisions for implementing Regulation (EEC) No 2052/88 as regards the financial instrument of fisheries guidance (FIFG). Secondly, Council Regulation (EC) No 3699/93 of 21 December 1993, laying down the criteria and arrangements regarding community structural assistance in the fisheries and aquaculture sector and the processing and marketing of products. More over, the effects on environment should be considered.
Rural Development	Preservation of rural environment

6.2.1.2 Review of criteria related to employment

The ability of projects to create employment is one of the main criteria usually used in the project selection procedures in regions of Objective 2, 6 and 5b. In Objective 1 regions the most important criterion is the ability of the project to contribute to the general development goal while the criterion of job creation is given a complementary role. This is usually the case for actions supporting R&D or innovation. Additionall!, for the case of basic infrastructure (e.g. telecom-

[1] European Commission 1997 b and 1997d

munications. rail), emphasis is usually given on the modernisation according to European-\vide technological trends.

Project selection procedures used in Structural Funds' interventions include checklists, scoring systems or a combination of these.

When checklists are used for the selection of projects, the contribution of the project to employment is evaluated using various versions of the following three criteria:

- Ability of the project to create additional jobs;
- Ability of project to safeguard/protect/retain jobs (i.e. jobs already existing which would have been lost if the project had not taken place); and
- Upgrading of employment skills and improvement of employability (especially for training actions).

An example of an evaluation procedure that uses a checklist of criteria is that of Finland.

In the Objective 2 regions of Finland the expected effect on employment is the main criterion for selecting projects, The criteria used for the estimation of employment impact are based on the above three, which have been further analysed in order to facilitate their estimation. Every project financed under the Single Programming Document should fulfil at least one of the following:

1. Considerable direct effects on employment (e.g., employment provided by investment projects during the construction phase. including project staff).
2. Effect on employment once the resulting activity has started.
3. Employment effects resulting from stimulation of growth.
4. Employment effects in terms of nen. upgraded or retained jobs resulting from business investments.
5. Employment effects through improvement of the employability of members of the labour force or existing employees b? means of training. research or development projects.

The above approach uses as a criterion the gross employment created. without taking into consideration negative effects on other social groups. geographical areas or SMEs.

An alternative way of selection is the use of scoring systems. In this case indicators that measure certain expected impacts of the project are being used instead of non-quantifiable criteria. Finally the indicators are combined using weights in order to calculate a final score for each project to be calculated.

For example. in the UK a two-step scoring system is used. Firstly. the projects must satisfy a certain number of basic criteria in order the project to be eligible for funding. Secondly. there are specific criteria. including the creation of employment. for evaluating the quality of a project in relation to the corresponding measure. Each project has to prove in the first place its ability to create **net employment.** If it fails to do so, it has limited chance of being selected. The expression of the criteria at quantitative terms is based on unit cost indicators corresponding to the type of operation concerned. So the criterion of contribution to employment is expressed as cost per job created. Finally a ranking is generated according to the cost/job-created ratio and the most efficient i.e. those with the higher ratio are financed.

A similar process is followed in the French region of Prevence-Alpes-Cote d'Azur.

The UK approach is a good esample in the sense that it relies on the creation of net employment.

6.2.2. Methodological issues

An effective selection procedure should ensure that:

- selected projects satisfy the objectives of the interventions supported by Structural Funds:
- projects are in line with the major objectives of EU policies and especially those related to the employment, sustainable development and equal opportunities
- benefits are maximised in the framework of the existing options.

Therefore, such a procedure should include:

- a set of reliable selection criteria:
- a methodology that constructs an "eligibility filter" based on the criteria selected. which excludes from funding projects not contributing to the intervention objectives and EU policies on employment. sustainable development and equal opportunities; and
- a procedure that sets priorities for the funding of projects that overcome the eligibility filter

6.2.2.1 "Eligibility filter"

The eligibility filter is the first check point where all the projects that are not in conformity with the objectives of the measure and the EU policies should be excluded. This first appraisal of the projects is vital for the success of the selection procedure. In order to ensure the effectiveness of the filter. the following steps should be pursued:

1. In order to check if the project contributes to the objectives of the measure. a set of **core eligibility criteria** is created. These criteria reflect the operational objectives of the measure and differ from one measure to the other.
2. **A** set of **EU policy eligibility criteria** is created suitable for the assessment of the contribution of the project to the achievement of EU policy objectives on the employment. sustainable development and equal opportunities. If the objective of the measure is one of the above. then the relevant criteria are taken into account once.
3. **A** project is selected and moves to the next stage only if it pass through both checkpoints (step 1 and step 2).

EU policy eligibility criteria for employment

Projects supported by Structural Funds should at least not have negative effects on employment. If the project covers investments on infrastructure then the estimation of the impact on employment should follow the impact assessment procedure. used during the es-ante evaluation of an intervention. If the project is of a significant size then most probably it has been included in the programme during the planning phase and therefore it has passed trough this procedure already In any case the method described in section 5.4.2 and in Table 6 should be used. The outcome of the exercise will be the number of net jobs created or the number ofjobs safeguarded.

If projects are related to different kinds of support for the productive sector (other than infra-, structure) then the estimation of the contribution on employment should be based on a combination of the following:

- the number of jobs lost due to the increase of productivity;
- the number of jobs created or safeguarded due to the gron-th of the firm.

If the project is related to training the direct net employment will be estimated combining the following results:

- the number ofjobs lost due to the increase of productivity as a result to the training;
- the number of jobs created or safeguarded due to the growth of the firm as a result of the training;
- number of beneficiaries expected to find job sis months after the completion of the training

EU policy eligibility criteria for sustainable development

Eligibility criteria related to the sustainable development should include at least the folloning criteria:

- compliance with EIA (Table 13 present the type of projects that should pass from EIA)
- compliance with EU and National environmental regulations (Table 12 presents key environmental legislation applied to specific types of actions)
- if specific environmental targets has been set for the region (e.g. reduction of CO_2 emissions by 5%) project's environmental effects should conform with those targets:
- the associated environmental infrastructure and resources should be suitable in terms of capacity and performance (e.g. in the case of a plant, water supply and treatment. waste collection and disposal system should be adequate).

EU policy eligibility criteria for equal opportunities

Projects should have positive or neutral effects on the following:

- living conditions which meet women's needs;
- women's access to the job market:
- situation of women at work:
- women's participation in the creation of socio-economic activities

6.2.2.2 Priority Setting

The projects that pass the "eligibility filter" are ranked according to a score

Again two groups of parameters are important. The first group of core parameters is related to the operational objectives of the project, The second group of EU policy parameters consist of the:

- contribution to employment parameter:
- contribution to sustainable development and quality of the environment parameter:
- contribution to equal opportunities parameter.

Each parameter is receiving a score that reflects the performance of the parameter. Below we present and indicative method for calculating the score for the three EU policy parameters

A weight attributed to each criterion should trade-off benefits and impacts between economic, social and environmental priorities and it depends on the particular priorities and objectives of the intervention in question and the global Stntctural Funds' Objectives for the region. The critical thing is that the weighting should done in a transparent fashion.

The scores attained from each criterion are added giving the overall score of the project. Finally the projects with the higher score. given the budget constraints, should be funded.

Where possible the weighting system should be used to encourage the incorporation of positive environmental attributes (e.g. environmental friendly technolog),) by increasing the weight for the environmental parametre.

Scoring for the employment parameter

The proposed method for the quantification of project's performance on employment creation is similar to that used in UK and in the French region of Prevence-Alpes-Cote d'Azur. The performance is determined in quantitative terms using a unit cost indicator. For each project the net job-created/cost ratio is calculated. This way the project with the lower cost per job created receive the higher score for this parameter.

Scoring for the sustainable development parameter

The sustainable development parameter will be calculated using a checklist of criteria Each criterion met adds a number of points to the parameter's score. The checklist of criteria is based on the impact indicators shown in Table 5 and it is further enhanced in order to include the specific requirements of the intervention. Table 15 shows an example of a scoring technique easily adapted to the requirements of specific measures.

Table **15** Example of project scoring system for sustainable development -Transport[22]

Criteria	Yes	No
Will the project reduce the air emissions arising from transport'?		
Will the project reduce the noise levels arising from transport?		
Will the project reduce road traffic and transportation time'?		
Will the project lead to better traffic management or promote public transport use?		
Will the project provide public transport access to sites not previously served by public transport. or will they serve declined sites which are a focus for development		
Will the project include appropriate mitigation measures to minimise any adverse environmental consequences arising from infrastructure investment?		
Will the project remove or reduce traffic in areas which are particularly sensitive to road traffic. such as near schools or in residential neighbourhoods'?		
Total score		

15 points for each Criterion met up to a maximum of 100

Scoring for the equal opportunities parameter

Each project is scored according its effect on the key types of impacts identified earlier in the study. The following table provides an example of a relevant scoring system.

[22] The table is adapted from European Conunission (1998a). Table v1.1

Table 16 Example of project scoring system for equal opportunities

Criteria	Yes	No
Will the project improve living conditions which meet women's needs;		
Will the project facilitate women's access to the job market;		
Will the project improve situation of women at work:		
Will the project facilitate women's participation in the creation of socio-economic activities		
Total score		

50 points for each criterion met up to a maximum of 100

7 Ex-post evaluation of programmes of regional assistance

The objectives of es-post evaluation are to:

- determine the results which can be actually attributed to intervention. including result on employment, sustainable development and equal opportunities;
- to compare the outcomes with the expected results as the have been defined at the ex-ante and interim evaluations, including those related to employment, sustainable development and equal opportunities;
- assess the estent to which the assistance has actually achieved its objectives including also the objectives related to employment, sustainable development and equal opportunities.

Commission has provided guidance on es-post evaluation methods through a quite large number of different sources such as the various MEANS publications, Commission's own guidelines and various evaluation studies. many of them presented in conferences organised by the Commission. Nevertheless, the variety and fragmentation of information sources and approaches, a general model for the es post evaluation of Structural Funds' interventions exist and it is followed by the evaluators with variations which depend on the their experience and the particularities of the interventions.

The main problems that should be solved in an evaluation are among others.

- how to identify and measure changes relevant to the objectives of the intervention: and
- how to identify the changes that can be actually attributed to intervention and to exclude those created by other causes.

The Commission's model faces the above problems combining a 'bottom-up' and 'top-down' method of impact evaluation.

The *top-down* approach compares the situation before with that after the intervention in order to capture the overall impact and net effects of the intervention. In doing so the values of the baseline indicators before and after the intervention are compared and the difference represents a first estimation of the overall impact. In order the results to be assessed and further refined the performance of assisted region is compared with non-assisted areas[73], Also macro-economic models are used like the **HERMIN** model applied in Ireland and Spain.

The baseline indicators used are those defined during the es-ante evaluation The indicators suitable for capturing the effects of technology on employment. sustainable development and equal opportunities have been presented in the section 6.1.1. Their measurement is based mainly on published statistics and their quality is depended on them.

The advantage of this approach is that it captures global impacts and especial the indirect and long term effects. The weakness of the method is. on the one hand that it cannot identify the contribution of specific measures. This is very important in the case of environmental impacts where statistics are measuring a lot of indicators[74] all at the level of country. On the other hand it is difficult to isolate the impact of Structural Funds from the impact of other influences and trends and to identify the relationship between cause and effect.

[73] See also the method followed by Ernst &Young for the evaluation of assistance in Objective 2 regions in Malan, Jack (1998)

[74] See chapter 5 of the study

The *bottom-up* approach supplements the top-down approach. It measures the value of a set of result and impact indicators (see section 5.I) at the level of measure and goes up to the level of programme according the model presented in section 5.1. Whereas the two approaches (i.e. bottom-up and top-down) are complimentary the synthesis of their result is an issue that need further improvement"

The data for the calculation of result and impact indicators are collected at the level of individual projects e.g. the direct environmental impact of an energy plant is assessed measuring the consumption of energy resources, the emissions etc. However, in this example indirect effects like esternalities are difficult to be measured. They are better captured with a top-down method. Also the direct net increase of employment can be measured calculating the new jobs created during the operation of the plant deducting those employs moved there from other occupations. Agaio what it is difficult to be measured are the indirect effects like the displacement effect. impact multiplier effects and deadweight.

In order to measure the impact indicators and to collect additional qualitative information several methods are used. **A** description of all these methods exceeds the scope of this study as they vary according the sector, the type of intervention and even the specific local conditions.

The above discussion on the methodology gives the framework for the estimation of the impact of the intervention. As soon as the impacts have been identified and measured the issue that. should be clarified is the estent to which the intervention has actually achieced its objectives.

This can be done by compering the achievements (results and impacts) of the intervention with the targets set for the specifics and general objectives, according the methodology presented in section 5.1 and in Figure **4.**

[5] *See* also Malan. Jack (1998).

8 Conclusions regarding strategy on evaluation and project selection

There is a recognised need that the sustainable development and quality of the environment. the safeguarding or creation of new jobs and the promotion of equal opportunities should be taken into consideration during the planning and evaluation of interventions and selection of projects.

Further to Commission recommendations and the practices of the Member States. an assessment of the exploitation of technology should be additional introduced as an integrated part of the impact evaluation. As already argued, the use of technology can support or undermine the efforts for sustainable development, increase of employment and equal opportunities. Therefore. it is crucial to assess the mode technolog!. is incorporated into regional interventions as well as the expected impact.

The creation of an intervention of regional assistance is a process where decisions taken in early stages affect profoundly the latter ones. Hence. the decisions on the objectives and general content of measures. taken during the drafting of Operational programmes and Single Programming Documents affect the criteria used for project selection and decided at later stages Therefore it is important that all the potential impacts are identified early in the process of thc Regional Development Plan preparation and the ex ante evaluation of the individual Operational Programmes and Single Programming Documents.

The evaluation of the conformity of the projects with the EU policies on employment, sustainable development and equal opportunities can be carried out effectively only if the general objectives of the intervention, as well as those of the measures at lower levels, are quantified and specific indicators to signal the progress towards the achievement of the objective are set.

The impact indicators for the evaluation of interventions proposed within this study should be used on a minimum set and should be further enhanced in order to fulfil all to the requirements of specific interventions under question.

At this point the definition of a set of baseline indicators establishing the status of the regions before the intervention is also crucial. This set should be compatible with the indicators used for expressing the targets and those used for the evaluation of results and impacts.

Lack of, or inadequate baseline indicators and lack of quantified targets will negatively affect the quality of any assessment. The baseline indicators proposed in the present stud! could be used as a starting point. It should be pointed out that it is impossible to foreseen all type of possible interventions that could be supported by Structural Funds in order to include relevant baseline indicators beforehand. Therefore. when specific Operational Programmes or Single Programming Documents are being planned, the proposed lists of indicators should be adapted to the particular objectives and particularities ofthe intervention under question.

Regional authorities do not always meet effectively the above issues (i.e. the quantification of objectives and the creation of baseline and impact indicators) during the planning of an intervention, due to the complexity of the structuring effects of interventions. the lack of experience and the absence of a reliable set of statistical data. This is especially true for environmental data where the following problems has been identified: scientific uncertainties and lack of knowledge: lack of precision in measuring the impact: low quality of existed environmental statistics: in some cases geographical areas affected by interventions are not compatible with the division followed by environmental statistics.

The procedures applied for the selection of projects is also crucial, especially for the fulfilment of the objectives of sustainable development and protection of the environment. An effective selection procedure should ensure that:

- selected projects satisfy the objectives of the interventions supported by Structural Funds;
- selected projects are in line with the major objectives of EU policies and especially those related to the employment, sustainable development and equal opportunities
- benefits are maximised within the framework of existing options.

Therefore. such a procedure should include:

- a set of reliable selection criteria:
- a methodology that constructs an "eligibility filter", based on the criteria selected. excluding from funding those projects which do not contribute to the intervention objectives and EU policies on employment, sustainable development and equal opportunities: and
- a procedure that sets priorities for the funding of projects that overcome the eligibility filter.

At this point it should be mentioned that the eligibility filter should not only take into consideration the conformity to the EU policies. excluding projects that for example have some negative environmental impacts but the development and cohesion objective served by the specific project. These two requirements should be balanced at the priority setting phase of the selection procedure using a scoring and weighting system. In doing so elaboration of the project prioritisation methodology and especially on the scoring and weighting system is necessary. In order to do so. specific studies by category of intervention should be conducted. since a universal approach for all type of actions and development priorities is impossible.

European Commission has played a very important role in initiating and guiding the development of evaluation methods, but there is still a lot of additional work to be done. Evaluation methods need to be further elaborated and improved for the results to have any credibility and be used by policy makers. The improvement should go beyond the definition of different sets of indicators and should also cover the methods that ought to be used for the analysis and interpretation.

The evaluation of the impacts on sustainable development is an area where the efforts should be focused since it is the most complicated. and all the approaches developed so far. mainly by International organisations are not fully compatible with the logic of Structural Funds interventions and the evaluation practices used hitherto. The indicators and methodological issues presented in this stud:. are starting points that should be further developed.

Further efforts are also needed in order to create a more cohesive methodolog!. and set of indicators for the evaluation of impacts on equal opportunities.

In addition there is a need to develop methods that will synthesise the top-down and bottom-up approaches. Top-down approaches need to be further elaborated improving the macro-economic models used and diffusing the results and the experience throughout the Member States and regional authorities.

Further improvements are also necessary on the collection of statistical data that should be appropriate in order to measure the expected effects at various programming levels.

Annex I: Bibliography

1. Delphi International (1997), *The role of financial institutions in achieving sustainable development,* Report to the European Commission.
2. Cattaneo. Gabriella (1993). *The Microeconomic Impact of Advanced Communications in Europe,* Paper presented to OECD Workshop on the Productivity Impacts of Information Technology Investments, November 11-13
3. COM (96) 67 final. *Incorporating equal opportunities for women and men into all community policies and activities.* Communication from the Conunission.
4. COM (95) 509 final. *Communication on Cohesion Policy and the Environment.*
5. COM (95) *602* final, *Amended proposalfor a Council Decision on the Fourth Medium-Term Community Action Programme on Equal Opportunities-for Women and Men (1996-2000)*
6. Commission Européenne (1997) .*Mesurer la création d'emplois: Comment évaluer les effets des interventions des Fonds structurels sur l'emploi,* Série Evaluation et Document No. 1. Mai 1997
7. EEA (1998). *Europe's Environment: The Second Assessment,* Copenhagen
8. ESRI (1997), *CSF Mid-Term evaluation.* Final Report
9. European Commission (1998a), *A Handbook on Environmental Assessment of regional Development Plans and EU Structural Funds Programmes,* final report
10 European Commission (1998b). *Environment and employment: Building a sustainable Europe.* Belgium
11 European Commission (1998c), *Indicators for Sustainable Development*
12 European Commission (1998d), *Indicators for monitoring and evaluation: A methodological guide,* Draft.
13 European Commission (1998e), *The ex-ante evaluation of the 2000-2006 interventions Objective 1 and 2: A technical and explanatory document by the Commission's services.*
14 European Commission (1998f), *Evaluating the application of the principle of equal opportunities in Structural Funds interventions: Methodological proposal.*
15 European Commission (1997a), *A study to Develop and Implement an Overall Strategy for EIA SEA Research in the EU,* Final Report
16 European Commission (1997b). *Sweden: Single Programming Document 1995-99. Objective* 6
17 European Commission (1997c), *Finland: Single Programming Document. Objective 2 1997-99.*
18 European Commission (1997d), *Finland: Single Programming Document. Objective 6 1995-99.*
19 European Commission (1997e), *Evaluating EU Expenditure Programmes: A guide. Ex post and Intermediate evaluation,* First edition.
20 European Commission (1997f), *The Structural Funds in 1996: 8th annual report*

21. European Commission (1996). *evaluating the Contribution of the Structural Funds to Employment,* MEANS Handbook n° 6.

22. European Commission (1994a), *Perspectives for economic and social impacts ofadvanccd communications in Europe,* PACE.

23. European Commission (1994b) *United Kingdom: SPD for Greater Manchester. Lancashire and Cheshire. Objective 2 1994-1996.*

24. European Commission (1994c), *SPD of The Highlands and Islands 1994-1999. UK: Objective 1*

25. European Commission (1994d), *Operational Programme for Agriculture 1994-1999. Greece: Objective 1*

26. European Commission (1993a) *Growth, Competitiveness. Employment: The Challenges and ways forward into the 21st Century*, White Paper.

27. European Commission (1993b), *Implementation of Directive 85 337 EEC on the assessment of the effects ofcertainpublic and private projects on the environment*

28. European Parliament (1996). *Report on the Commission Communication on cohesion policy and the environment (COM(95))*, Committee on Regional Policy

29. Freeman, C. and Soete, L. (1994), *Work for All or Mass Unemployment?*, Pinter Publishers, London.

30. Global Vien (1998), *Evaluation of Operational Programmes "Roads". "Rail". "Urban Development - Athens Metro': "Telecommunications", "Mail".* Volume c' Telecommunications. Second Report, Athens

31. Government of Ireland (1994a), *Operational Programme for Industrial Development 1994-1999,* Stationary Office, Dublin.

32. Government of Ireland (1994b), *Operational Programme for environmental .services 1994-1999.*

33. Government of Ireland (1994)c, *Operational programme for Transport 1994-1999*, Stationary Office. Dublin.

34. Harrop. Jeffrey (1996). *Structural Funding and Employment in the European Union: Financing the Path to Integration.* Edward Elgar, Cheltenham, UK

35. Horelli. Lisa (1996). *Engendering evaluation of Structural Funds Intervention: Methodological reflections*, paper presented at the European Conference on Evaluation Methods for Structural Funds Intervention. Berlin 2-3 December.

36. Lee Norman and Joanna Hughes (1995). *Strategic Environmental Assessment Legislation and Procedures in the Community*, Study for European Commission. DG XI.

37. Malan. Jack (1998), *Translating theory into Practice: Lessons from the es post evaluation of the 1989-93 Objective 2 Programmes.* Ernst & Young, UK, paper presented at the European Conferencc on Evaluation Practice in the Field of Structural Policies. S e d a 16-17 March.

38. Ministry of National Economy (1994a). *Operational programme for the Environment,* Athens

39 Ministry of National Economy (1994b), *Operational Programme Klisthenis*, Athens

40 Ministry of National Economy (1994c), *Operational Programme Telecommunications*, Athens

41. Ministerio de Economia y Hacienda (1995). *PITMA II Environmental Programme.*

42. Ministerio de Economia y Hacienda (1994). *Science Infrastructure Programme*

43. OECD (1998a), *Technolog]: Productivity and Job Creation: Best Policy Practices*. The OECD Jobs Strateg!,.

44. OECD (1998b), *DAC guidelines jòr gender equality and women's empowerment in development co-operation,* Development Assistance Committee.

45. OECD (1997a), *Sustainable Flexibility:* **A** *Prospective Study on Work. Family and Society in the Information Age,* OCDE/GD(97)48,Paris.

46. OECD (1997b), *Global Information Infrastructure-Global Information Society (GII-GIS): Policy Requirements*, C/MIN(97)11/ADD.Paris

47. OECD (1997c), *Information Infrastructures: Their impact and regulatory requirements*, Committee for Information. Computer and Communication Policy,OCDE/GD(97)18 Paris.

48. OECD (1995a), *The Global Environmental Goods and Services Industry*, Paris

49. OECD(1995b), *Technology and Environment. Policies to promote Technologies for Cleaner Production nnd Products: Guide-for Governments Self-Assessment,* OCDE/GD(95)21, Paris

50. OECD (1994), *OECD Statement on the Benefits of Telecommunication infrastructure competition,* Paris.

51. OECD (1992), *The OECD Environmental Industry: Situation, Prospects and Government Policies.* OCDE/GD(92)1. Paris

52. Spenner. K. (1985) "The Upgrading and Downgrading of Occupations: Issues. Evidence, and the Implications for Education", *Review of Educational Research.* Vol.55, No 2.

53. STOA (1995), *The Impact of Technologicnl Change on Employment within the European Union between 1984 nnd 2025*. Directorate General for Research, Luxembourg

54. STOA (1994). *EU energy policy*, final report. Luxembourg

55. STOA (1991) *EC Policy an energv and environment.* final report, Luxembourg

56. Pianta Mario et al (1996), "The dynamics of innovation and employment: An international comparison". *STI Review* No. 18

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