

**Korea-Germany Statistical  
Cooperation Meeting  
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# **한·독 통계협력회의 결과보고서**

**2002. 12**



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## I. 회 의 개 요

1. 회의 일정
2. 회의 결과(요약)
3. 참가 소감

## I. 회의 개요

### 1. 회의 일정

□ 일 시 : 2002. 10. 23. ~ 10. 28.

□ 장 소 : 독일연방통계청, 비스바덴

□ 참석자 : 김설희 통계품질관리팀장, 인구분석과 김동희 서기관,  
통계분석과 최정수 사무관

□ 회의 일정 및 독일측 회의 참가자

○ 10. 24.(목)

#### - 오전 회의

- Mr. Halen 독일통계청장 환영사
- 환경계정 공동프로젝트 결과 프리젠테이션  
(Mr. Luetzel 부청장, 국제협력과장, 담당과장 및 관계자)

#### - 오후 회의

- 양국의 인구동태통계 비교 프리젠테이션  
(담당과장, 국제협력과장 및 관계자)
- 인구통계 및 환경계정에 관한 세부 토의 (동시 진행)

○ 10. 25.(금)

#### - 오전 회의

- 양국의 통계품질관리에 관한 프리젠테이션  
(Mr. Radermacher 총무국장 및 관계자)
- 환경계정에 관한 세부토의
- 인구동태 작성에 관한 혜센주 지방통계청 방문

- 오후 회의
  - 회의 평가 및 향후 협력방향

## 2. 회의 결과 (요약)

< 통계품질관리 >

### □ 면담자

- Mr. Walter Radermacher(총무국장), Mr. Sebastian Czajka, Mr. Ulrike Cieplik (품질관리담당)

### □ 회의 내용

- 한국측 품질관리 현황 및 품질평가체계 설명

- 독일측 품질관리 접근방법 설명

#### 1) TQM(Total Quality Management) 3단계 접근방법

- 전략수립: EFQM(European Foundation for Quality Management) Excellence Model, Fit 2005 발전계획, 연간 업무계획 등
- 품질진단: 자체평가, 절차분석, 품질보고제도, 직원 및 이용자 만족 조사, 조사비용 조정 등
- 품질개선: 경영정보시스템(MIS), 예산책임의 분산, 절차최적화, 프로젝트 경영방식도입, 직원제안제도 'Market of Ideas', 인력발전계획 등

#### 2) 통계작성절차 분석기법

- 부서별 목표업무선정, 모니터링 및 평가, 절차최적화 및 설계

### 3) ESS(European Statistical System)의 품질전략 응용

- 품질상태공개, 응답자 요구사항 조사, 기관장 리더십, 품질관리 체계화, 직원만족도 개선 등

### 4) 이용자에게 통계품질 및 작성절차 공개를 위한 표준개발(진행중)

- ESS 품질지표, 잠정치와 확정치 차이설명, 표본오차 등

## □ 협력방향

### ○ 한국측 의견

- 독일 통계청은 ESS, EFQM 참여 및 EU 국가간 양자협력 등을 통하여 품질관리를 발전시키고 있으므로
  - EU품질체계 및 독일의 적용기법을 습득하기 위하여 지속적인 교류 희망

### ○ 독일측 의견

- 한국의 품질평가체계 중 평가지표 및 현장조사 모니터링 방법 등에 대한 관심을 표명하고 2003년 ISI 개최 기간중 별도 한·독 협력 회의 제의

## < 인구동태 통계>

## □ 면담자

- Mrs. Koehler(인구동태과장) Mrs. Sommer(인구동태팀장)

## □ 회의내용

- 독일측의 한·독 인구동태통계의 비교에 관한 설명

### 1) 인구동태통계의 작성과정 및 체계

## 2) 최근에 나타난 인구동태통계의 주요 지표의 비교

- 인구 규모 및 피라밋, 자연증가율, 출생률 및 평균수명
- 혼인 및 이혼건수 추이, 남녀의 초혼연령 등

## 3) 통독 전후의 급격한 인구통계의 변화 등

### ○ 한국측의 최근의 한국의 인구현황 설명

- 1) 총인구 및 연령별 인구의 변화
- 2) 주요 인구의 당면과제
  - 인구고령화, 수도권의 인구집중심화
  - 높은 40~50대의 남녀 사망률비 및 탈 가족화 현상 등

## □ 상호 합의내용 및 향후 협력방향

- 양국의 인구동태통계 비교에 관한 최종보고서 발간을 위한
  - 인구동태통계에 관한 정의 비교
  - 다양한 인구지표의 비교를 위한 상호 데이터 보완
- 급격한 한국의 인구변화에 대한 전망 추가 보완
- 최종 보고서 작성 및 발간을 위한 최대한 상호협조
  - 양국 통계청의 기관저널 수록 검토
  - 2003년 ISI에 공동발표 등

## < 환경경제계정 >

## □ 면담자

- Mr. Schoer(환경계정과장) Mr. Schweinert(환경계정 담당)

## □ 회의내용

- 독일측의 양국의 환경효율성 비교에 관한 한·독 협력프로젝트 결과 분석 설명
  - 1) 양국의 환경효율성 비교를 위한 정의 및 개념
  - 2) 경제와 환경의 비교 결과
    - 경제활동을 위해 사용된 환경요소 지표 비교
      - 1차 에너지소비, 총 용수량 및 폐수 발생량, 지구온난화, 산성화 등
      - 생산성(GDP/환경요소) 분석을 통한 환경효율성 도출
  - 3) 경제활동별(산업 및 가계) 이산화탄소 배출량 분석 및 비교
- 한국측의 한·독 협력프로젝트에 사용된 기초 데이터, 방법론 및 진행상태 설명
  - 1) 프로젝트의 유용성, 개념 및 범위
  - 2) 방법론 및 문제점
    - 기초 데이터의 수집절차 및 추정방법
    - 데이터의 질 및 문제점

## □ 상호 합의내용 및 향후 협력방향

- 양국의 환경효율성 비교에 관한 최종프로젝트 보고서 발간을 위한 잠정프로젝트 결과의 문제점 보완
  - 프로젝트는 금년 12월 말에 완료 합의
- 최종 보고서 작성 및 발간을 위한 최대한 상호협조
  - 양국 통계청의 기관저널 수록 검토
  - 2003년 ISI에 공동발표 등

## 3. 참가 소감

< 전반적인 소감 >

- 독일측은 향후 협력회의를 양국의 일반적인 협력뿐만 아니라 실무적인 협력결과를 원하는 느낌을 받음
  - 예를 들면, 양국의 관심 주제에 대한 공동 프로젝트를 수행한 결과물 발표 등
- 한국통계청의 통계기획 및 분석에 대하여 상대적인 인적 자원의 빈약에도 불구하고 참가단의 전문성에 대하여 깊은 관심 표명

### < 환경 경제 계정 >

#### □ 협력의 필요성 및 진행상황

- 환경계정관련 한·독 협력연구프로젝트는 2001년 8월 대전에서 한·독 협력회의시 필요성이 제기되었음
  - 2001년 협력회의에서는 양국의 환경경제계정 개발 및 구축에 대한 일반적인 정보 교환은 있었으나 구체적인 사례에 대한 검토가 부족하였음
    - 따라서 구체적으로 실제업무에 활용하기 위해서는 지속적인 정보의 교류 및 공동작업이 필요하다는데 양국이 공감대를 형성하였음
    - 이를 위해서 국제적 비교 및 국내개발 현실을 정확하게 평가하는데 기준이 되는 '양국비교 협력연구프로젝트'를 진행하기로 합의
- 2002년 상반기부터 본격적으로 프로젝트 일정에 따라 양국의 환경 및 경제관련 데이터 구축 및 분석을 양국에서 진행하였으나,
  - 우리청의 경우 우리나라 환경관련 기초통계의 부족, 이론적 방법론에 대한 낮은 이해도와 프로젝트 담당인력의 업무부담으로 인하여 많은 어려움이 따랐음
    - 또한 외국기관과 E-mail(영어)을 통한 프로젝트 진행의 경험부족으로 일정추진과 이메일 토론상의 한계를 종종 드러냈음

- 반면 독일의 경우, 전문인력이 본 프로젝트에만 투입됨으로써 업무의 추진력 및 효율성이 상당히 높은 상태임

#### □ 기대효과 및 향후 방향

- 환경계정관련 프로젝트는 2002.12월까지 완료될 예정이며 이를 토대로 향후 양국의 환경계정구축 방법론에 대하여 지속적으로 의견을 교환하기로 함
- 본 협력프로젝트를 통하여 우리청에서는 국제적인 개발진행상태, 우리나라 환경관련 기초통계의 부족, 개념과 이론적 방법론에 대한 구체적 이해, 프로젝트 담당인력의 과제 및 수행방법 등 경험을 습득하였음
- 독일 통계청의 경우는 최근 신흥경제대국으로 부상하는 한국을 모델로 양국의 경제와 환경상태를 비교함으로써 양자간 국제협력프로젝트의 기준 및 방향을 설정한 것으로 판단됨
- 향후방향
  - 환경경제계정 개발 및 구축은 전문인력과 지속적인 국제협력이 절대적으로 필요하므로 국제적으로 선도그룹 국가와 정보교류가 요청됨
    - 2002년말에 완료되는 1차 협력연구프로젝트의 결과에서 부족한 부분에 대한 정보교류가 지속적으로 진행되기를 양국은 희망
    - 이를 위해서 전문개발 인력투입이 절대적으로 필요함
  - 우리청의 경우 국제적인 환경경제계정 개발 및 구축에 동참하기 위해서 우선적으로 환경관련 전문인력의 양성이 절대적인 과제임

#### < 품질관리 >

#### □ 추진배경

- 2002.9월 한국측에서 2002년 한·독 통계협력회의 새로운 주제로

서 ‘품질관리’를 추가할 것을 먼저 제의하였고 독일측에서 이에 동의함으로써 이루어졌음

- 본 협력회의의 다른 주제들과 달리 ‘품질관리’ 부문은 처음 채택된 주제이므로 회의일정도 1회만 실시하였고, 여기서 양국 품질관리 현황을 소개하고 문제점에 대한 토의를 진행하였음

#### □ 독일측의 품질관리 현황

- 독일은 유럽연합(EU) 국가로서 통계부문에서도 유럽국가의 통계를 통합관리하는 유럽통계시스템(ESS, European Statistical System)에 연방통계청이 참여하고 있으며 이 그룹의 추진방향 및 권고사항을 받아들여 품질관리를 진행하고 있음
  - 따라서 통계품질관리는 의무적으로 추진하여야 하며 ESS내에 형성된 LEG에서 정하는 권고사항에 따르고 있음
    - 품질관리시스템 도입, 품질평가, 직원인식조사 등을 실시하여 장기적으로는 결과보고를 하고 있음
- 독일의 국가통계제도는 연방통계청을 중심으로 한 분산형의 통계제도를 취하고 있으며 예산, 인력은 물론 통계자료의 수집, 결과공표에 이르기까지 지방통계청 및 기타 통계작성기관들이 철저히 독립되어 있음
  - 품질관리에 있어서도 연방통계청에서 국가통계의 전반적인 방향 설정 및 체계의 구축을 담당하고 이를 권고하고 있으나 지방통계청의 저항이 있어 효과적인 접근방법을 강구중임
- 독일통계청이 현재 안고 있는 과제 및 문제점은 국가통계를 담당하는 각국 통계청과 거의 유사함
  - 즉, 예산의 긴축 및 통계조사에 대한 저항은 커지면서도 보다 다양하고 많은 통계요구와 품질을 갖추어야 하며 통계제공 매체를 다양화해야 하는 요구를 받고 있는 점 등

#### □ 공통 문제점 토의

## ○ 평가대상부서의 저항

- 한국통계청에서는 평가대상부서에서 평가에 따른 업무부담 및 평가자체에 대한 저항이 있는 것과 마찬가지로 독일통계청에서 는 지방통계청의 협조를 얻는데 상당한 어려움이 있음

## ○ 직원들의 인식 부족

- 독일은 지난 2차대전 이후 통계청을 비롯한 정부기관의 직장분위기가 상당히 경직되어 있고 권위적인 체제로 일관해 왔기 때문에 직원들, 특히 하위직 직원들의 업무개선 건의가 받아들여지지 않아 왔음
  - 따라서 'IDEA MARKET'과 같은 캠페인을 열어 전직원을 참여시키는 운동을 전개하고 있으며, 워크샵도 20여차례를 실시하여 품질관리에 대한 교육 및 홍보에 주력하고 있음
  - 이에 총무국장인 Mr. Walter Radermacher는 워크샵을 개최할 것을 권유하였음

## □ 양국협력 추진방향

### ○ 한국측 의견

- 통계청에서는 통계품질관리가 아직은 개발단계에 있으므로 유럽연합의 품질관리체계와 개별국가의 적용방법에 대해 지속적인 연구를 필요로 함
  - 한·독협력을 통하여 두 가지 필요사항을 충족할 수 있어 지속적인 협력체계 구축을 희망

### ○ 독일측 의견

- 한국에서 추진하고 있는 품질평가 지표 및 관리가 체계적이고 구체적으로 진행되고 있어, 독일측에서도 한국의 방법론을 배우기를 바라며 부문별 논의를 위하여 계속 협력을 희망해 옴

### ○ 협의결과

- 2003년 베를린에서 개최될 ISI의 Invited Paper Session 'Quality Management'에서 실무자간 면담을 갖고, 동 ISI의 개최기간 동안 별도로 한·독 협력회의를 갖기로 합의함

## II. 회 의 결 과

1. 통 계 품 질 관 리

2. 인 구 동 태 통 계

3. 환 경 경 제 계 정

## II. 회의 결과

### 1. 통계품질관리

#### 가. 독일 연방통계청의 품질관리 현황

##### □ 연방통계청의 현행 문제점

- 예산 규모삭감 (2002 예산 규모 129백만 유로화)
- 통계 자료에 대한 수요 증가 추세
- 좀 더 복잡한 통계분석에 대한 수요 증가
  - 여러 분야의 통계를 연결한 분석, 각종 정부기관 보고서 및 신규 지표 개발 등
- 통계품질에 대한 요구사항 증대(시의성, 정확성, 비교가능성 등)
- 통계에 대한 각종 비판 경향 심화
- 통계의 대외제공 방법의 변화 요구
  - 인쇄물이 아닌 e-products(인터넷 서비스) 증가 추세
- IT기술에 의한 통계생산과정의 구조적인 변화 급속

##### □ 당면과제

- 통계청 관리자급의 목표
  - 통계청 운영의 효율성 향상
- 통계청 전반적인 추진목표

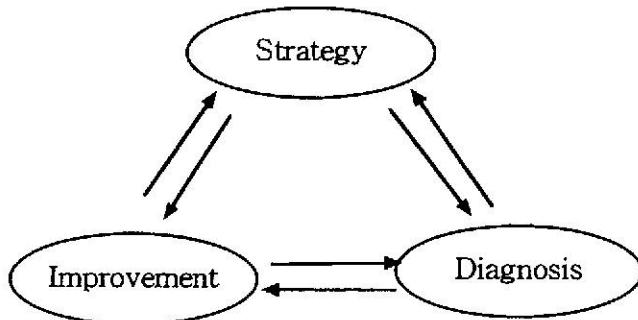
- 통계품질 개선, 이용자만족도 향상, 직원만족도 제고

#### □ 예산절감 과제(일명 “Rules of the Game”)

- 연방통계청 내 각 부서별 품질개선 계획과 향후 5년 이내 30% 예산을 절감해야 하는 환경 하에 업무를 추진해야 하는 부담을 안고 있음
  - 예산절감 목표 30%에는 기본예산 절약 7.5%, 신규과제 투자 7.5%, 업무추진 중 예산절감 7.5%이 포함되어 있음
    - 신규과제 : 부서별 “Contest of Idea” 실시 결과

#### □ 연방통계청의 품질관리

- 품질관리 운동의 3단계
  - 전략 수립 (Strategy)
  - 품질 진단 (Diagnosis)
  - 품질 개선 (Improvement)



- 전략수립단계
  - Total Quality Management
    - EFQM<sup>1)</sup>의 Excellence Model을 기본으로 운영
  - 통계청 이미지 관리운동 일명 “Leitbild”
  - 전략목표 수립 및 사업추진 계획
  - 매년 부서별 업무계획 설정

1) European Foundation for Quality Management, 부록 유럽의 품질관리 현황부분 참조

- 품질진단 방법

- 자체평가 (EFQM-Model) 실시
- 통계작성 과정분석
- 통계결과에 대한 품질보고서 발간
- 직원 만족도 조사 실시
- 이용자 만족도 조사 실시
- 비용분석 및 절감

- 품질개선방법

- 통계를 위한 경영정보시스템(MIS, Management Information System) 운영
- 예산운용의 책임을 각 부서로 분산화
- 통계작성 과정의 최적화 및 현실화
- 기존의 업무체계를 프로젝트 관리 체계로 전환
- 직원 제안제도 실시
  - “Market of Ideas”
- 개선을 기본으로 한 각 부서별 사업계획 수립

## □ 통계작성 과정분석 및 직원참여 유도 전략

- 품질개선 과정에 직원참여 유도방법

- 품질개선 책임의 분산
- 최고관리자(통계청장)와 직원대표와의 협약 체결
- 각 부서별 활발한 업무정보 교환
- 통계작성과정의 분석에의 참여 운동 전개

- 실천전략 전환

- 종래 접근방법
  - 상관으로부터 상세한 지시 및 통제에 의한 생산성 향상
  - 강제 또는 강요에 의한 변화 추구
  - 인력의 추가 요구에 대한 객관적인 측정
  - 상호 불신임 가운데 업무 추진

- 부서별 분산체제 접근방법
  - 창의적이고 개혁적인 직원에 의한 생산성 향상
  - 동기부여 및 부서 자체 사업별 우선 순위 설정에 의한 변화 추구
  - 통계작성 담당의 책임 하에 새로운 아이디어 개발
  - 자유로운 창의력에 의한 직무분석
  - 상호 지원 및 신뢰
- 통계청장과 직원대표간의 협약 체결 내용
  - 새로운 인사정책 및 인력개발 계획 전반에 대하여 직원들의 참여
  - 직원들의 전문적인 교육에 대한 융통성 있고 적극적인 대처
  - 현재 비스바덴(Wiesbaden)에서 본(Bonn)사무소 이동 계획이 확정됨에 따라 예외 직원에 대한 신축성 있는 처리
  - 파트타임 및 재택 근무에 의한 직원채용 확장
  - 저임금 그룹 직원에 대한 해고 및 강등 금지
  - 장기적인 재구성에 의한 인사관리

## □ 직원간 정보교환 방법

- 50회 이상의 워크숍을 통한 통계품질관리 기본정보 교육
- Kick-off-Workshops을 통한 문제연구
  - 과정분석의 필요성, 과정분석 방법, 과정분석에서의 개별 직원의 역할 등 심층 연구
- 홍보 팜플렛 및 내부 레터(Letter) 개발
  - 현 상황을 근거로 한 통계품질 개선운동 전개
  - 전략목표, 기업이미지 등 전달
- 내부 인터넷 운영

## □ 통계작성 과정분석 단계

- 내재된 잠재력 분석
  - 부서별 작업그룹을 구성하여 가장 중요한 과정 선정
- 현행 업무과정에 대한 비판
  - 선정된 과정에 대하여 소규모 작업그룹을 구성하여 상세한 평가 및 분석
- 통계작성 과정의 최적화 및 재설계
  - 소그룹에서 작업 진행
- 개선실천 여부 결정
  - 부서별로 구성된 작업그룹에서 소그룹의 제안을 수정하고 청장에게 결과 및 개선계획 보고
- 개선추진
  - 품질개선 실천을 위한 구체적인 계획 수립(책임, 일정 및 통계방법 등)

## □ 통계작성 과정분석을 위한 직원의 참여 범위 확대

- 통계청 내 부서별 잠재력 분석
  - 각 소속 부서별로 주요 통계 및 업무 선정
- 업무과정에 대한 평가 및 분석
  - 각 소속 부서에서 통계작성 과정에 대한 모니터링 및 평가
- 최적화 및 설계

## □ 통계작성 과정분석 주요 결과

- 2000.10월부터 2002.3월까지(18개월)동안 10개 부서에서 통계작성 과정분석을 위한 단계별 추진
  - 2,800명 연방통계청 전체 직원 중 850명(30%)이 참여

- 각 부서별 요구사항에 대한 조정위원회의 추진여부 등 선정작업
  - 그에 따른 개선작업이 현재 진행 중임
- 통계작성 과정분석이 진행되는 동안 품질개선에 대한 1,081개 아이디어가 제안되었음
  - 품질개선을 위한 가능성 탐진
  - 궁극적으로 34백만 유로(통계청 예산의 26.4%)의 비용효과 기대

## 나. 품질지표의 대외공표

### 통계품질 상태를 통계 이용자에게 알려주기 위한 품질지표 개발

- 통계품질 및 조사방법에 대한 이용자 서비스를 위한 표준개발
  - 통계청 내 내부 작업그룹을 구성하여 추진
  - 작업목표
    - 이용자에게 통계의 품질상태를 공표하기 위한 개념 정의
    - 대외공표용 통계품질 지표 개발
    - 방법론에 대한 설명방법 개발
    - 품질정보의 공표를 위한 표준 양식 개발

### ESS<sup>2)</sup>의 품질기준 체택

- 관련성(Relevance)
- 정확성(Accuracy)
- 결과발표의 시의성(Timeliness)
- 통계자료의 이용가능성 또는 투명성(Transparency)
- 비교가능성(Comparability)
- 다양한 주기별 자료의 일관성(Coherence)

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2) European Statistical System, 유럽통계시스템에 대한 참고자료 참조

## □ 최종결과의 잠정치와 확정치사이의 평균산출

- 양 부호(+, -)에 대한 평균
- 최종 확정치 결과에 대한 사전 예고
- 보도자료 및 일반보고서에 첨부 예정

## □ 표본오차

- 합계에 대한 상대표준오차
- 증가율에 대한 절대표준오차
- 공표방법은 검토 중

< 참고 >

### 유럽통계시스템의 품질관리

독일통계청의 품질관리를 이해하려면 우선 유럽통계시스템 (European Statistical System, ESS)에서의 품질관리를 파악하여야 하기 때문에 본 자료를 정리하였음. 독일은 유럽연합의 한 국가로서 연방통계청에서 유럽통계시스템에서 결정하는 품질관리 권고사항을 받아들여 업무에 적용시키고 있음.

### 1. Leadership Expert Group(LEG)의 품질에 대한 최종보고서

- 1999년 스웨덴 통계청에서 ESS내에 품질을 개선하기 위하여 「LEG on Quality」 구성할 것을 제안
  - 2 가지 주요 이슈
    - Total Quality Management(TQM)
    - Current Best Method(CBM)
  - LEG는 품질관리를 위한 과제 제시 및 권고 안을 개발하여 각국 국가통계기관 및 Eurostat에 제공하는 역할을 담당
  - LEG에 참여한 국가들

- 스웨덴(회장), 프랑스, 독일, 이태리, 그리스, 네덜란드, 포르투갈, 영국
  - 노르웨이, 아이슬란드 : network countries
- LEG에서 논의된 주제들
- 품질프레임워크
  - 8개 LEG국가 및 8개 network국가의 품질관리 실태
  - 품질과 이용자의 관계
  - ESS의 강점 및 약점
  - 자료의 품질
  - 서로 다른 품질관리모형 및 관계
  - 평가도구(Evaluation Tool)
  - Current Best Method 및 Minimum Standard
  - 문서화
  - 정보제공
  - 국가통계작성기관의 품질관리 구현

- 권고안(1) : 각 국가통계기관은 ESS가 정한 품질 차원과 부차원 (Sub-Dimension)에 따라 통계제품의 품질에 대한 보고서를 작성하여야 함
  - 권고안(2) : ESS의 품질 차원 및 서브차원에 대한 측정 가능성이 확보되어야 함
  - 권고안(3) : 통계작성 과정별 평가가 중요하므로, 주요 과정변수의 파악, 과정에 대한 평가 및 평가결과 분석에 대한 핸드북 등을 반드시 개발하여야 함

- 제품 품질과 과정 품질의 비교
  - 제품의 품질 : 국가통계기관이 제공하는 다양한 대외공표 자료 및 서비스의 품질을 의미

- 과정의 품질 : 제품은 일련의 과정을 통해 생산되는 통계제품의 좋은 품질은 과정의 평가 및 개선으로 얻을 수 있음. 즉, Edwards Deming의 PDCA(Plan-Do-Check-Act) 사이클 이론을 도입 필요

권고안(4) : ESS의 각 기관들은 반드시 체계적인 품질개선 대책을 수립하여야 하며, 기 채택한 모델이 없는 경우에는 반드시 EFQM의 Excellence Model을 채택하여야 함

- TQM 접근방법

- 생산과정, 고객중심, 리더십, 전직원 참여의식 등을 통하여 조직이 지속적으로 품질을 개선해 가도록 유도 가능

권고안(5): 응답자 및 자료제공자의 관계 관리

- 국가통계기관에서는 자료제공자(응답자)들과 관계 증진을 위하여 노력하여야 하며 자료제공자들이 조사에 대해 응답하는 사실을 어떻게 받아들이는지를 연구 분석이 필요함
  - 응답자의 부담을 경감시키고 자료제공자들에게 사회에서의 통계의 역할에 대한 경각심을 증진시키기 위한 집중적인 연구 필요

- Business Excellence Model의 예

- Malcolm Balridge National Quality Award
- Swedish Quality Award
- European EFQM(European Foundation for Quality Management)

- 기타 ISO품질인증, Balanced Score, Business Process Reengineering (BPR)도 이용가능

- 정부통계 작성을 위한 자료의 제공자는 다른 분야의 자료 제공자들과는 달리 보상을 받지 않고 통계생산자들이 협조하고 참여하도록 추궁을 받게 됨.

- 그러나 응답자들의 응답거부는 무응답, 응답지연 및 측정의

### 오류를 초래

- .. 비밀보호 보장, 통계법, 윤리강령 등 보장 필요
- .. 답변에 예민한 질문의 억제 및 타당한 수준의 질문 수를 유지해야 함, 불가피한 경우는 인센티브 부여 등 조치 필요
- .. 표본설계의 효율화, 효과적인 조사표 설계, 이증자료 수집방지, 자료 제공자들간의 응답부담에 대한 공정한 분배, 응답자가 선호하는 조사방법 개발, 응답자의 중요한 역할 강조 등

### 권고안(6)

- ESS회원 국가는 주요통계에 대하여 서비스수준 협약을 수립하여야 함

### 권고안(7)

- 고객만족도 조사의 설계, 실시 및 결과분석이 반드시 수행되어야 함

### 권고안(8)

- 각 회원국가는 계획수립에서부터 이용자의 참여를 포함한 이용자와 생산자 간의 의견을 교환한 것에 대한 보고서를 작성하여야 함. 품질문제에 대하여 이용자에 대한 인식을 제고하는 방법을 회원국들이 서로 교환하면서 이용 가능하도록 하여야 함

### ○ 고객중심의 개념은 국가통계 품질관리의 기본원리 중 하나임

- 이용자의 요구가 점차 다양하고 복잡해짐에 따라 보다 큰 관심을 가지고 추진하여야 할 분야임
  - 이용자와 생산자의 의견교환을 통하여 통계의 특성 및 작성과정, 통계작성 프로그램 등에 맞는 통계시스템을 정의해야 함
  - 어려움은 있지만 품질제고를 위하여 이용자를 통계작성과정에 처음부터 참여시켜야 함

### - 이용자와 생산자간 의견교환 방법

- 통계위원회를 구성하여 외부 전문가들이 주요 통계작성 프로그램 개발에 대하여 토의

- 통계위원회의 분과위원회 성격으로 이용자-생산자 그룹을 형성하여 특별 분야에 대한 토의
- 주요 이용자그룹의 수요를 예측하기 위한 고객조사
- 통계작성 담당과 통계별 주요 이용자간의 공식적인 협약체결(영국의 Service Level Agreement)
- 서로 다른 통계의 이용자들에 대한 사회과학 리서치 수행
- 사회과학, 경제 및 시장조사 분야별 파트너십을 통한 협조 추진
- 통계수치에 대한 품질특성 및 활용 가능성에 대하여 이용자에게 홍보활동 전개

○ 이용자 만족도 조사

- 이용자의 수요를 파악하여 정부통계의 개발계획 수립 과정에 반영시킬 수 있게 함
- 방법론적인 문제 여전히 내재하고 있음
  - 체계, 만족도 개념, 척도, 무응답 처리 등

권고안(9) (ESS의 성과 및 미흡한 점)

- ESS의 주요 성과 및 미흡한 점에 대한 심층적인 분석을 통하여 실천계획이 추진되어야 함

○ 파레토(Pareto)원리를 적용하여 ESS의 강점을 개발하고 약점을 개선 추진

○ 주요 성과

- ESS를 통하여 각 국가간 파트너십과 자율적인 기법습득을 증진
- ESS를 구축을 통하여 Eurostat와 대부분 국가에서 품질관리가 체계적으로 추진되고 있음

○ 미흡한 점

- 시스템 운영을 위한 전반적이고 지속적인 우선 순위가 설정되지 않은 상태

- 작업팀 및 Taskforce팀의 협력과 효율적인 운용이 미흡
- Eurostat와 ESS회원국가들 간에 협조가 미흡
- 국가통계작성을 위한 일정 계획이 일부 비현실적임
- 각 국가간 Eurostat와 회원국가간 직원 교류에 어려움이 있음

권고안(10) Current Best Methods(CBM)

- 각 회원국가는 대부분의 공동 과정에 대한 CBM을 개발하고 CBM구축방법, 보급, 실행 및 CBM의 개선 등에 대하여 핸드북을 개발하여야 함.

권고안(11) 표준화를

- 통계생산을 위한 일련의 권고안들이 개발되고 ESS에서 타당성을 검토한 후에 작업을 추진하여야 함

- 유럽국가 전체를 통합시킬 수 있는 CBM이나 Minimum Standards를 구축하는 것은 타당성이 없기 때문에 회원국가에서 각자 추진하고 LEG에서는 대신 Quality Guidelines과 Recommended Practice 구축을 검토하고 있음
- CBM : 자료편집, 무응답 예방 등 구체적인 통계작성 과정에 필요한 최선의 방법 발굴

권고안(12)

- ESS 회원국가들은 LEG에서 작성하여 권고하는 정보관리 및 자료제공 기준을 채택하여야 하며 경우에 따라 내부에서 이용하는 방법도 고려할 수 있음

권고안(13)

- 현재 ESS 정보시스템에 대한 이용자 요구사항을 반드시 검토하고 Eurostat 현행 데이터베이스의 확장을 고려하여야 함

권고안(14)

- 조사방법론 및 통계품질을 주제로 하여 적어도 2년에 한 번씩 국제회의를 주선하여 개최하여야 함

- Minimum Standards : 통계작성과정의 특정부문 수행시 만족할

최소의 필수 기준이며 제품의 성질이 아닌 조사기획시 요구사항을 의미 (표본추출 확률, 조사원 평균 업무량의 상·하한 등)

- Quality Guideline : 통계생산을 위하여 보편적으로 인정된 원칙들의 모음으로 제품의 품질에 영향을 미치는 효과의 정도를 설명하며 실무자들은 최종적인 결정을 나름대로 할 수 있음
- Recommended Practice : 조사기획 담당이 선택 가능한 우수한 방법론들을 모은 것으로 CBM은 Recommended Practice의 부분임

○ 정보제공

- 정보제공 과정을 개선하는 것도 품질개선의 중요한 요소임
- LEG에서 다양한 수준의 사례를 개발
  - 통계작성기관간, 국가통계작성기관과 Eurostat, 국가통계기관과 국제기구(UN, ILO, OECD, IMF, FAO) 등
- ESS내의 정규적인 포럼 개최의 필요성 제기
  - 단기과정도 연결 운영가능

권고안(15)

- ESS내의 자체평가 프로그램을 위한 검검표 개발이 시급

권고안(16)

- 다양한 수준과 목표에 따라 감사 방법을 검토하여 권고안 마련이 필요

권고안(17)

- 직원인식조사(Staff Perception Survey)를 반드시 수행하여야 함

○ 자체 품질평가

- EFQM
  - LEG에서는 각 국가통계기관에서 수행평가시 EFQM모델을 사용도록 권고하고 있음
- Simple Checklist
  - 네덜란드, 영국 및 뉴질랜드 등 통계청에서 고안한 것으로 통계작성과정과 결과물에 대한 점검표

- 뉴질랜드 체크리스트의 예(일부)

- 주요 이용자 및 새로운 이용자를 파악하는 프로그램이 마련되어 있는가
- 문서화를 철저하게 하고 있으며 항상 이용 가능한가
- 표본이 정기적으로 재설계되고 있는가
- 계절 조정된 통계결과를 분석하고 있는가
- 자료공표의 일정을 미리 예고하고 있는가
- 자료작성에 소요된 시간 요구사항에 부합하기 위해 마련된 표준을 준수하고 있는가
- 공표자료에서 비밀보호사항이 점검되고 있는가
- 품질지표를 정기적으로 점검하고 모니터링하고 있는가
- 현행 통계법을 준수하고 있는가

○ 외부평가자 채용

- 네덜란드 품질감사팀

- 통계작성 과정 및 결과물에 대한 품질감사시스템을 운영, 감사 표준은 Provisional Quality Guideline으로 하며
  - .. 5년주기로 40명의 감사요원으로 구성된 별도의 독립된 감사 팀을 운영
- 매년 감사결과 미흡한 점을 발견하여 청장에게 보고
  - .. 기관내 부서간 협조 및 의사소통 부적절
  - .. 방법론적인 기법 미흡
  - .. 업무분장 및 책임의 불명확성
  - .. 결과제품의 품질 저하 등

- 국가간 검토작업 (네덜란드 및 스위스 통계청)

- 신속한 문제점 발견 및 개선제안 가능
- 3일 ~1주일 소요

○ 직원 참여 유도

- 조직내 분위기 변화를 평가

- 협력작업과 발전계획이 잘 진행되는지 판단 가능
- 조사표 및 지표를 통한 개선제안제도
- 직원 인식정도 파악 필요

권고안(18)

- 회원국가 통계청에서는 각자 문서화 현황을 분석하여 보고서로 제출하여야 함. 이 보고서에는 개선내용 및 일정이 우선순위를 정하여 포함되어야 함

권고안(19)

- 각 회원국가 통계청에서는 사명, 자료보급정책 및 품질정책이 포함된 문서를 작성하여 외부에 공개하여야 함

○ 문서화의 목적

- 품질 개선을 확실히 하고, 이용자가 통계자료 이해하고 사용하는데 편의를 제공하는데 목적이 있음

○ 통계기획자와 문서화

- 후임자가 전임자의 업무를 그대로 전수 받도록 하기 위하여 필요

○ 문서화의 내용

- 통계작성과정 및 정보내용의 메타자료
- 제품에 대한 품질측정 및 지표
- 조직의 운영 전략, 정책 및 사용자와의 관계 등 관련 자료

○ 문서화 도구 개발 필요

- 기 생산된 정보의 재활용
- 문서화의 표준화
- 업무 추진 실패사례도 문서화 필요

권고안(20)

- 각 기관에서는 직원들의 수준에 따라 차별화된 프로그램을 개발하여 교육·훈련을 시켜야 함

권고안(21)

- 각 국가 통계 기관에서는 2년 정도의 주기로 국가통계에 대한 품질상(Quality Award)을 마련하여 개별 개선프로젝트팀, 우수 실적 기관 또는 통계작성팀에게 수여하여야 함

○ 체계적인 품질관리시스템 구현 필요

- LEG에서는 채택가능한 방법 및 전략을 개발 또는 지정하여야 함
- 각 국가의 형편에 따라 적용가능
  - 법률제도, 예산능력, 방법론적인 지원, 문화적인 배경

○ 공통 적용 분야

- 고객 또는 이용자
  - 통계작성 계획수립 및 작성단계에 적극 참여시킴으로써 통계 결과의 관련성 강화
  - LEG에서는 이용자와 생산자의 관계 개선을 위한 방법을 제시하여야 함
- 통계생산과정
  - 과정으로 효율화 및 표준화 시킴으로써 제품의 품질 제고 가능
  - LEG에서 CBM, 품질측정, 문서화, 실험방법 등 지정
- 전직원의 참여유도
  - 최고 관리자부터 하위직에 이르기까지 직위별 전체 직원 참여가 필요
- 지속적인 개선이 ESS의 생존전략임
  - 그렇지 않을 경우 정책결정의 기본제공 역할을 상실하게 됨

○ 품질관리시스템의 개발 및 구현을 위한 주요 과정

- 고위관리직에서는 조직의 목표를 정의해야 함.
  - 목표는 그 조직의 비전, 사명선언 및 주요 추진사항 등에 의하여

## 결정됨

- 직원들은 품질아이디어 제안에 대한 동기부여 및 권한위임을 받음.
  - 직원들로 하여금 품질개선을 적극적으로 추진할 수 있게 해주는 제도적인 기반구축이 필요
- 품질관리시스템의 구축을 하나의 투자로 간주하여야 함.
  - 초기비용이 들기 때문에 초기투자를 위한 자원을 확보하여야 함
- 품질관리를 위한 별도의 조직이 필요함
- 조직내 품질의 현실태를 평가하는 것이 초기의 필수적인 작업임.
  - 품질관리를 착수하는 시점에서 벤치마킹과 같은 작업을 하여 가장 시급히 개선이 되어야 할 아이디어를 발굴하여야 함
- 조직의 주요 과정들을 분석하고 평가 및 개선의 대상으로 삼아야 함
- 모든 직원들이 품질관리에 대해 교육을 필수적으로 이수하여야 하며 일부 직원들은 품질촉진 요원(Quality Pilot)으로서 특별 교육을 이수하여야 함
- 통계별 품질개선 노력은 반드시 모니터하고 평가하여야 함

### 권고안(22)

- LEG 구현을 위한 그룹이 형성되어 권고안에서 정의한 품질관리 활동에 협조하여야 함
- LEG는 권고안을 지속적으로 개발하여 보급하여야 함
  - 2가지 타입의 권고안
    - 개별적인 ESS회원국가에 대한 권고
    - 신개발 또는 공통작업에 대한 권고
- 정보수집 및 권고안 작성을 위한 Implementation Group 구성 필요
  - 통계품질평가를 위한 Working Group도 추가로 필요

## 2. ESS의 품질관리 체계

### □ ESS의 품질에 대한 정의

- LEG에서는 ISO(International Standards Office)의 품질에 대한 정의를 통계결과물과 통계서비스 양면에서 모두 적절한 것으로 인정
  - ISO정의: the totality of features or characteristics of a product or service that bear on its ability stated or implied needs of customers

### □ ESS의 TQM(Total Quality Management)

- TQM : 제품과 서비스의 품질전반에 대해 중점을 두고 기업을 관리하는 경영철학
  - EFQM 모델, Malcolm Baldridge Award, 일본품질상 등
- LEG에서는 ESS에서는 TQM은 통계자료 및 작성과정 두 가지 품질을 다루어야 한다고 봄
- TQM의 주요 관건
  - 이용자 요구사항 구축, 이용자 요구사항과 자료제공 현황과의 차이, 통계생산 과정의 개편 계획 및 실시, 신규시스템 운영, 결과의 배포, 이용자 요구사항과 구축된 표준과의 차이에 대한 재평가 등
  - EFQM
    - 결과 중심, 고객위주, 리더십 및 방향설정, 정보관리, 인력개발 및 참여유도, 지속적인 학습, 개혁 및 개선, 파트너십 및 공적 책임
    - 8가지 기준
      - 5 enablers : 리더십, 정책 및 전략, 인력관리, 자원 및 과정
      - 5 results : 고객만족, 인력/직원 만족도, 사회 및 주요 결과에 대한 영향

## □ 회원국가들의 품질관리 현황

- 대부분의 국가가 택하고 있는 품질관리 지표에서 공통으로 이용자, 직원, 효율성, 신뢰할 수 있고 공정한 자료생산 등을 채택
- 대부분 국가들이 통계제품에 대한 품질보고서(Quality Report) 또는 품질선언(Quality Declaration)을 채택하고 있음
- 이용자들이 평가하는 품질수준과 자료이용시 유의사항을 전달하는 의사소통 도구로 품질선언 내용을 활용
- 품질차원 중 relevance, accuracy, timeliness 및 accessibility 네 가지는 공통으로 채택하고 있으며 나머지 품질차원 중 comparability, coherence, completeness 등은 ESS의 checklist에서 사용
- 품질관리에 대한 향후 계획은 국가에 따라 다양하며, 일부 국가에서는 상세한 계획을 수립한 반면, 다른 국가에서는 전체 사업계획의 일부로서만 포함되어 있음
- 대부분 국가통계기관에 이용자그룹이 형성되어 있으며 일부국가에서 이용자 만족도 조사를 실시하고 있고 일부 경우에는 이용자 협의, 서비스관리 등에 통계위원회나 서비스수준협약서 등도 포함되어 있음
- 그 외에 작성과정 자료, 자체평가 및 감사, 자료이용지도, 시스템문서화 및 표준화 툴 개발 등이 진행되고 있음

## □ ESS품질 관리를 위한 프레임워크 주요요소

- 이용자 요구에 의한 자문실시 - 이용자 요구사항 및 우선순위, 요구사항에 부합하기 위한 전략 개발 및 수행

- 제품 및 과정을 설계하고 수행하는데 이용자 요구사항 반영 - 필요한 자원, 전문성 및 기법, 방법론 및 툴 등을 도입하는 것도 포함
- 통계자료의 품질 및 작성과정의 품질관리에 중점을 둠
- 통계작성을 위한 자료제공자, 비밀보호 및 성실성들을 중시할 것
- 채택된 품질표준을 평가하고 품질을 측정하고 품질에 대해 보고서 작성
- 집계결과 및 메타자료의 보급, 문서화 자료 제공 및 이용자 지원
- 이용자 요구사항에 대한 피드백 평가 및 지속적인 개선 추진
- 결과자료의 품질보고를 위한 ESS의 품질속성 목록
  - 관련성 : 이용자의 수요를 반영시킨 개념, 조사방법 및 집계결과에 반영
  - 정확성 : 모수변수의 참값과 통계추정값 사이의 평균차이로 측정 가능
  - 시의성 및 정시성 : 이용자 수요에 대한 대응 정도
  - 이용가능성 및 투명성 : 이용자가 편리한 방법으로 자료 접근, 통계의 품질 및 통계작성 방법에 대한 정보의 이용자 제공
  - 비교가능성 : 시간과 공간에 대한 타당성 있는 비교 가능
  - 일관성 : 일관적인 표준 채택
  - 완결성 : 이용자 수요를 반영한 커버리지
- 통계작성과정을 위한 목적 정의
  - 효율성 : 바람직한 통계결과를 비용 효과적으로 산출
  - 효과성 : 바람직한 집계결과를 성공적으로 산출
  - 충실성 : 어려운 요구사항을 반영시킨 결과 산출

- 융통성 : 수요 및 요구사항의 변화에 적절히 대응 가능
- 투명성 : 공개적이고 가시적이며 쉽게 이해가 가능
- 성실성 : 다른 업무과정 및 전체 사업목표에 상호보완적이고 일관성 있음
  
- 품질관리 업무의 산출물에 대한 평가도 중요
  - 역량개발, 지원채용, 통신 등 협력지원 서비스

## □ 품질측정

- 품질측정의 중요성
  - 통계제품 및 서비스가 요구하는 수준에 부합하는지 평가
  - 신개발 및 품질개선프로그램의 진척상황 및 효과성 평가
  - 통계작성과정이 이용자의 요구 및 우선 순위에 부합하며 품질결과를 산출하는지 확인
  
- 품질보고 및 품질선언
  - 품계의 품질 수준 즉, 성과 및 미흡한 사항을 전달하는 수단
  
- 통계간 품질 측정
  - ESS에서 제공하는 품질속성목록 : 품질측정을 위한 framework
  - 조사과정의 문서화
    - 품질보고서의 일부 (ONS의 Statistical Quality Checklist)
  
- 기업통계의 품질모델 개발연구 프로젝트
  - Eurostat 자금으로 지원하는 사업
  - 3가지 부문
    - 품질평가 요약, 상세 품질보고서, 조사 및 조사과정 명세
  - 권고안
    - 품질평가작업에는 조사관리자 및 조사방법론 전문가들이 함께 참여하여야 함
    - 품질평가 툴을 마련하여 공유 필요 : 자원절감, 다른 조사들의

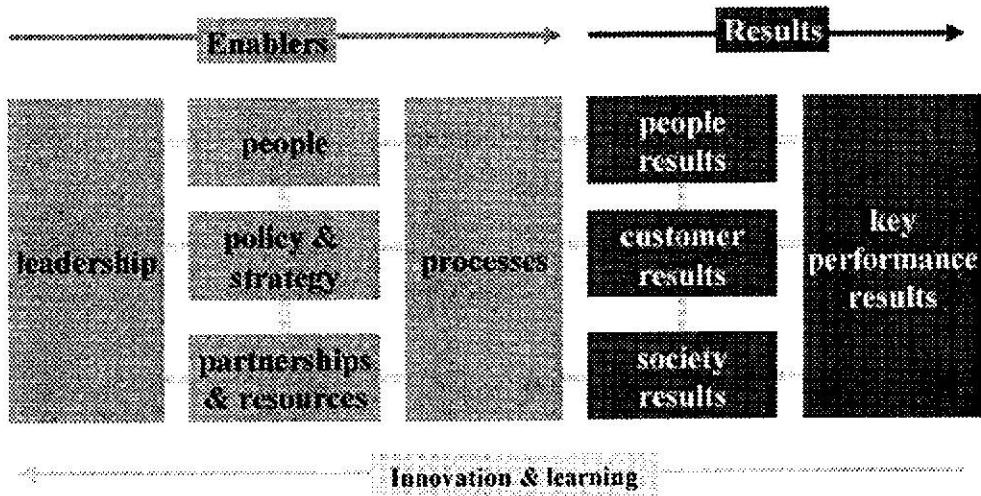
이용자들이 품질평가를 유사한 방법으로 실시하도록 함

- 자료의 활용가능성 중요
  - .. 모든 필요한 통계자료 일체를 필요시 사용가능하도록 대비하는 신중한 계획이 필요
- 품질평가과정은 품질정보를 최대한 활용할 수 있도록 하기 위하여 결과산출 과정의 하나로 인정하여야 함

#### □ ESS의 품질관리 프레임워크 : 향후 비전

- 품질관리모델 개발의 필요성 대두
- ESS 품질관리체계
  - 자료 및 통계서비스의 품질을 지속적으로 개선(품질관리과정, 틀 및 방법)
  - 고객의 필요와 이용자의 요구에 대응하는 통계서비스 및 제품에 중점적으로 추진
  - 품질실태 측정 및 품질보고서로 보완 가능
- 지속적인 품질개선
  - 통계 각 분야에 대하여 체계적이고 정규적인 평가
  - 오류 방지 및 효과적인 위기관리

## □ Total Quality Management : EFQM Model



## 다. ESS 회원국가의 품질관리 실태조사 결과

### □ 조사개요

- 2000년(2월~6월) 중 LEG 추진사업의 일환으로 16개 국가통계기관에 대한 설문조사 실시
  - 오스트리아, 벨기에, 덴마크, 프랑스, 핀란드, 독일, 그리스, 아일랜드, 아이슬란드, 이태리, 노르웨이, 네덜란드, 포르투갈, 스페인, 스웨덴, 영국
- 조사항목
  - 품질관리 체계
  - 품질관리 조직
  - 리더십
  - 이용자, 고객 및 관련성 정도
  - 직원
  - 팀웍 수준
  - 과정중심 (process orientation)
  - ESS의 우수한 점 및 미흡한 점

- 국가통계 작성기관들의 현행 문제점
- 전반적인 조사의 품질수준
- 주요 통계에 대한 통계품질수준
  - Labour Force Survey
  - Survey of Living Conditions
  - Consumer Price Index
  - National Accounts
  - Structural Business Statistics

## □ ESS의 성과 및 향후 과제

- 성과
  - 관련법규 제정
    - EC에서 체결된 신규 통계 개발에 대한 법적인 근거는 확실함
  - SPC 회의
    - ESS 관련된 중요 이슈를 논의하기 위한 국장급의 모임 진행
  - 모든 국가통계기관들의 협력관계
    - 개념정립, 방법론, 문서화, 공통규칙 및 우수한 핸드북에 관한 회원국가들의 협력관계
  - 상호 학습 가능성
    - ESS내에 상호 벤치마킹으로 기술적인 문제, 방법론, 표준화 및 정보교환 등
  - 15개 EU국가, 통계서비스 및 Eurostat들의 자원 및 경험 공유
    - EU자원은 신개발 및 연구/개발에 근원제공
  - EU 국가내 통계의 중요성 증대
- 미흡한 점
  - 자원부족
    - 여러 국가통계기관에서 자금 부족 현상
      - .. 국가적인 자원의 한계하에 기존의 요구사항을 그대로 구현해야하는 문제

- 이용자와 생산자간의 대화 부족
  - 예 : Commission과 ECB만이 통계이용자인 것으로 인식하는 경향
- 방법개발 미흡
  - ESS내에 국가간 서로 다른 통계작성 시스템 혼재
  - 표준화된 메타자료 시스템이 없음
  - 통계작성 사후연구가 너무 부족한 상태
- 우선순위 설정이 미흡
  - Commission내에서 우선순위가 너무 자주 바뀜
- 각급(국가 및 ESS 수준) 작업그룹과 Taskforce의 협조관계가 미흡

#### **라. 이용자 적합성 문제(이용자와 품질)**

- 이용자의 요구사항은 다양하고 부분적으로는 대립되는 양상도 있음
  - 이용자와 생산자의 복잡한 관계
    - 최적의 해결방안 마련을 위하여 필요
- 국가통계는 이용자 중심이 되어야 하는 이유
  - 이용자를 위하여 모든 결정이 이루어짐
  - 이용자는 품질의 기준을 결정하는 사람들의 그룹
  - 통계인들은 'number freak'가 아니고 'manager of statistics'로서 역할 대두

#### **□ 통계정보 상품의 특성**

- 통계정보 상품
  - 공공의 이익
    - 민주사회의 의사결정과정에 정보인프라 제공
  - 개인의 이익
    - 무료 정보 시장에서 거래되는 상품
    - 개별적인 고객에게 맞춤서비스 제공

## □ 통계이용자의 형태

### ○ 공공의 이익

- 사회 : 민주사회에서 의사결정을 대표하는 사람들
- 시민 : 국가통계에 대한 다양한 기대
  - 정부기관, 학술기관
- 제품과 프로그램이 사회 정치적인 대화를 통하여 결정

### ○ 개인의 이익

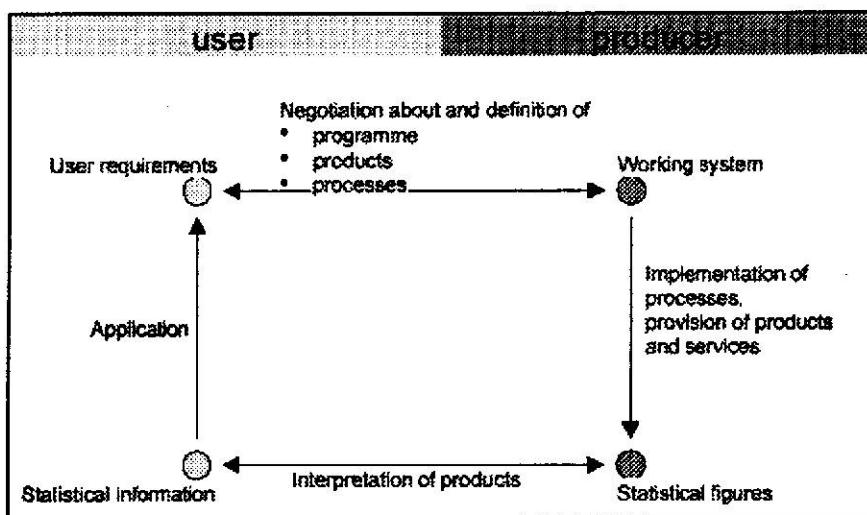
- 자료이용 유료계약 : 단기간
  - 언제 어떤 가격에 보급할 것인가 계약 조건
- 개별적인 이자의 요구와 기대는 직접 대화로 결정

### ○ 이용자 중심의 통계서비스는 달성하기 어려운 목표임

- 이용자만족을 개선
  - 공공의 이익인지 개인의 이익인지를 구분

## □ 이용자와 통계작성자의 복잡한 관계

- 이용자와 생산자간의 대화를 통하여 이용자 요구사항과 생산자의 능력에 맞는 해결방안에 대한 합의가 필요함



- Step1
  - 통계 이용자와 작성자간에 작업시스템에 대해 협상을 하게 되는데, 통계작성 작업에는 통계자료의 주요 특성(정확성, 시의성, 비교성 등), 작성과정의 전반적인 체계, 조직구조, 방법, 통계작성프로그램등이 포함됨
    - 두 그룹의 협상과정에서 이용자의 요구사항과 반대편의 생산자의 제약사항(예산 및 인력) 등 합의점을 구함
- Step2
  - 통계작성자는 Step1의 통계작업시스템을 실제 통계자료를 얻기 위하여 실행에 옮기게 됨. 이 과정은 보통 통계작성기관 내부에서 일어나며 이용자의 역할이 없음
    - 통계기관에서는 반드시 합의내용대로 실행에 옮기어야 함
  - 이 시점에서는 이용자가 실질적인 관여는 못하더라도 투명하게 진행되어야 함
    - 품질기준의 문서화, 품질기준에 대한 내부/외부 증명서 또는 품질상 수여(스웨덴 통계청) 등
- Step3
  - 일단 통계자료가 작성되면 이용자는 다시 통계작성자와 대화가 가능해짐
    - 이 시점에서 조사원시자료는 이용 가능한 (ready-to-use) 제품 즉 '통계정보'가 됨
  - 통계자료의 해석가능성은 통계기관의 중요한 과제
    - 각 통계자료에 맞게 메타자료가 제공되어야 함
    - 필요한 경우 다른 원천 또는 분야의 자료와의 연결 및 비교가 가능하여야 함
- Step4
  - 통계정보가 이용자에 의하여 실제 이용됨

## □ 이용자 만족도를 개선하는 방법

- 통계정보의 품질에 부합되는 요소
  - 통계작성시스템의 관련성
    - 통계작성시스템의 예산과 방법론적인 제약하에서 이론적인 이용자 요구사항의 현실화가 최선으로 이루어지고 있는가?
  - 통계작성 시스템에 의하여 실현된 통계의 품질
    - 측정 가능한 품질항목 어느 정도 수준의 품질이 얻어질 수 있는가?
  - 통계서비스의 품질
    - 이용자와 협의된 약속에 대하여 통계서비스에서 적절하게 실현시키고 있는가?
  - 이용자를 위한 통계수치의 해석가능성
    - 이용자들과의 상호 약속을 근거로 하여 예고된 통계정보를 이용자들이 해석 가능하도록 제공하고 있는가?
- 이용자 만족도를 향상시키기 위하여 고려할 사항
  - 이용자와 생산자의 대화에서 통계적 개념은 이용자의 요구에 부합하도록 구조화가 필요
  - 통계작성을 위한 구체적인 설계시에는 기준설정이 필요함
    - 이용자 만족도의 향상을 위해서는 이용자와 통계작성자가 기준이 되는 세팅에 협조가 필요
  - 통계작성자는 반드시 이용자들에게 통계수치를 해석하는 지침을 제공하여야 함

## □ 이용자와 통계작성자의 대화를 최적화 시키는 방법들

- 이용자 · 작성자간 효과적인 대화를 위하여 통계작성과정의 처음과 끝에 두 번의 회의를 개최하는 것이 바람직함
- Alpha회의
  - 이용자들을 통계작성 계획수립 과정에 참여시켜 이용자의 요구를

### 파악하는데 목적

- 서로 다른 이용자 요구들간의 상충 발생
- Pareto 최적화 기법을 사용하여 최대로 이용자 요구 사항을 반영 시킴
- Omega회의
  - 다시 pareto 최적화 기법에 의하여 이용자들이 만족하고 있는지를 확인
  - 이용자 만족도조사 등 관련 조사를 실시함으로써 이용자들로부터 피드백을 계량화해 볼 수 있으나 너무 기대하는 것은 곤란함
    - 심층적인 인터뷰와 통계위원회의 검토 등을 통하여 완성가능

## □ 조사계획 과정에 이용자를 참여시키는 방법

- 통계위원회
  - 통계기관 외부의 전문가들이 통계작성을 위한 일반적인 개발내용을 토의
  - 기능 : 이용자와 통계작성자의 연결, 통계작성 프로그램 제시, 신규조사개발에 대한 조정 및 감사 기능
- 통계작성자/이용자 그룹 : 위원회의 분과위 형식으로 개별 통계의 구체적인 문제를 토의
- 고객조사 : 주요 이용자 그룹의 수요 파악
  - 네덜란드와 스웨덴 통계청 등에서 정기적으로 실시하고 다른 국가에서는 대규모 조사시만 실시
- 통계작성자와 특히 중요한 통계이용자와의 공식적인 협약 체결
  - 영국 ONS의 Service Level Agreement
    - .. 기관간 협정(ONS와 HM Treasury) 및 서비스 수준 협약 (개별 통계의 품질내용)
    - .. 서비스 명세, 수행목표, 조정 및 관리 협의(통신 기능), 재정적인 배정, 수행모니터링 및 보고계획, 변동처리 절차

및 해결방법, 검토, 분쟁해결 및 중재, 비밀보호, 정보 및  
지적재산의 소유권 문제 등

## 마. 다양한 품질관리체계 및 상호관계

### □ 점검을 통한 품질관리

- 과거의 품질은 제품의 생산과정보다는 제품에만 초점을 두었음
  - 제품을 검사하여 반품 또는 재작업을 하도록 함
- 장점
  - 산출물 위주
    - 제품의 특성 및 명세서가 분명히 전달되고 이용자에게 전달 가능
  - 용용 및 이해가 용이
    - 특성을 정해 놓으면 생산자가 요구사항에 대해 주의하면 됨
- 단점
  - 지속적인 개선은 곤란하고 문제점이 있는 경우에만 개선 가능
  - 산출물 위주이기 때문에 조직은 전반적인 품질은 고려가 안됨

### □ Total Quality Management

- TQM의 기본 아이디어
  - 고객위주
    - 내부 또는 외부 고객의 요구사항에 부합되는지를 여부 강조
    - 고객의 가치를 더해주는 의미를 가지며, 내부의 고객도 포함됨
  - 리더십과 전직원의 참여
    - 고객 위주로 진행되기 때문에 기관장은 품질관리에 대해 의무적으로 추진하여야 함
      - .. 분명한 목표를 세우고 직원들이 특별한 기여를 할 수 있도록 유도
      - .. 전직원이 모두 참여하는 것을 전제로 하되 팀웍을 격려하고

모든 직원의 경쟁력을 개발하며 사실에 근거한 의사 결정하도록 유도

- 과정위주

- 조직운영은 수많은 과정으로 이루어지기 때문에 각 과정의 담당직원들은 권한과 책임을 다하고 작업과정, 최종제품 및 작업조직 등의 개선을 촉진시킴

- 변동사항의 측정 및 해석

- 통계작성의 주요과정 변수들과 다른 과정에의 효과 등을 꾸준히 측정함으로써 품질개선이 이루어지는 가능성을 확보 가능

- 지속적인 개선

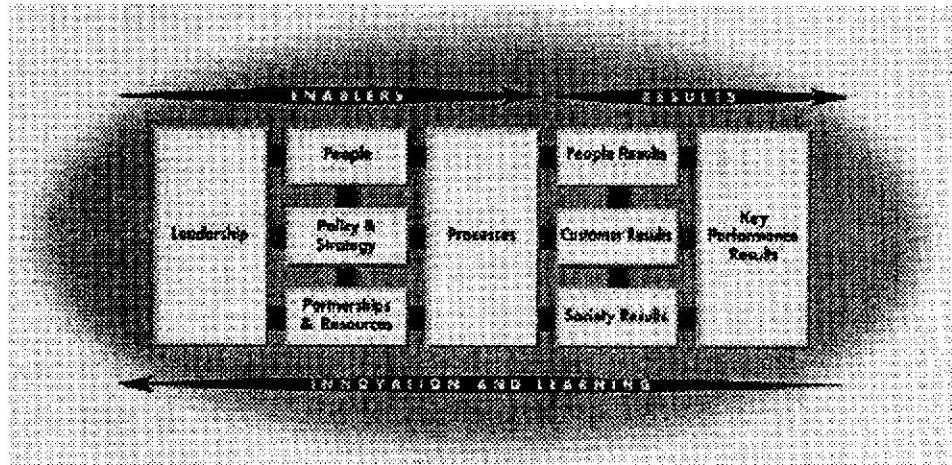
- 효율성과 경쟁력을 유지 개발하기 위하여 과정과 제품을 끊임 없이 개선하도록 하여야 함

○ EFQM Excellence Model

- EFQM에서 개발한 TQM형식의 품질관리 모델
- TQM을 구현하기 위하여 인식된 9개 기준(32개 세부 기준) 설정
  - Enablers
    - .. 한 조직이 무엇을 해야 하는가를 의미하는 5개의 기준으로 구성
    - .. leadership, policy, strategy, people, partnership, resources, processes
  - Results
    - .. 조직이 무엇을 성취해야 하는가
    - .. customer results, people results, society results, key performance results

○ EFQM 모델

- 업무담당자가 조직의 서로 다른 측면의 품질을 전반적으로 파악할 수 있게 해주는 도구
- 자체로는 조직의 업무수준을 향상시킬 수 없으며 단지 품질개선을 목적으로 둘 때 적절한 평가를 할 수 있게 해 주는 기본 제공



- 반드시 다른 품질개선 프로그램과 병행하여 채택 가능
- ISO접근방법과는 달리 상세한 문서화를 요구하지 않음(장점)
- 유럽국가에서 이미 성공적으로 이루어진 증거가 있기 때문에 국제적인 시스템으로 고려 가능
  - 다른 통계기관의 사례를 벤치마킹도 가능
- 조직내에 구현하는데 장시간 소요(단점)
  
- BSC(Balanced Score Card)
  - 조직의 업무수행상황을 평가하는 도구
  - 조직의 미션 및 전략을 수행지표로 변환시켜 평가 가능
  - 특징
    - 고객관점
      - .. 우리의 고객은 어떤 관점에서 우리기관을 평가하는가
    - 학습능력
      - .. 어떤 사항들이 우리 조직에게 계속적으로 개선할 수 있게 하고 있는가
    - 재정적 관점
      - .. 무슨 사항이 이해 관계자들에게 이익을 가져다 주는가
    - 조직운영 과정
      - .. 우리 조직운영의 필수적인 요소는 무엇인가, 우리는 경쟁가 능한가, 현대화된 툴과 기구를 사용하고 있는가

## □ ISO(International Organization for Standardization)

- ISO의 품질철학
  - “문서에 기록한대로 수행하고, 수행한 대로 기록하는 것”
- 조직내 사람들이 협약을 만들고 그것을 준수하는데 기초를 둠
  - 협약의 목표
    - 조직내 품질속성을 상세하고 측정가능한 정책으로 기록
    - 책임에 따라 부문을 나누어 조직을 구성
    - 조직내 과정간 중복 통제
    - 지침, 명세서 및 시험계획하에 과정을 통제
- 3가지 표준
  - ISO9000 : 품질을 보증하기 위한 품질관리 및 품질규칙
    - .. ISO9000:2000 : 신개정판으로 개발 및 개선에 중점을 두고 있어 EFQM에 근접
  - ISO9001 : 품질시스템 즉, 설계, 구축, 시험, 제품산출 및 고객서비스에서 품질을 보증하는 모델
  - ISO9004 : 품질관리 및 품질시스템의 요소 즉, 조직의 품질비용에 의하여 효율성 판단

## □ BPR(Business Process Redesign)

- BPR의 목적은 개선이며 ‘starting over’의 의미
  - “오늘 우리가 현재의 노하우와 기술을 습득한 채로 통계청을 다시 설립한다면 무엇을 하고 싶은가?”
  - 주요 성과 평가 즉, 비용, 품질, 서비스 및 신속성 등 측면에서 매우 효과적인(극적인, dramatic) 개선을 하기 위하여 조직운영과정(process)의 근본적인(fundamental) 재사고 및 혁신적인(radical) 재설계를 의미
  - 키워드의 의미

- Fundamental : 통계청이 반드시 수행해야 할 일과 수행하는 방법의 재설계. 모든 것을 당연하게 생각하지 않고 필수적인 개선사항을 발굴
  - Radical : 어떤 사항의 근본을 파악하는 의미로서 혁신하는 구조와 과정 모두를 무시하고 기존의 성취한 것의 신기법을 고안
  - Dramatic : 재설계는 최소한 또는 중여분의 개선을 의미하는 것이 아니라 수행능력에서 급격한 도약을 성취하는 것을 의미
  - Processes : 과정이란 하나 이상의 투입을 통하여 고객에게 가치있는 산출물을 만들어 내는 것을 의미. 개별적인 과정이 중요하지만 그 자체로는 별 의미가 없으며 전체 과정의 작용을 통해서만 제품과 서비스 창출이 가능
- 
- 재설계는 기존의 과정을 강화시키는 것이 아니라 기존의 과정을 철폐하고 전혀 새로운 것으로 교체하는 것을 의미
  - BPR의 장점
    - 과제에 대한 기존의 관습과 방법으로부터 탈피하여 기회를 부여함
  - BPR의 단점
    - 모든 과정이 반드시 근본적이고 극적인 변화가 필요한 것은 아니며 조금 조정하고 조절함으로써 개선이 가능할 수 있음
      - 한정된 시간과 자원내에서는 곤란
    - 따라서 획기적인 개선과 새로운 가능성의 보일 경우에 가능
  - BPR과 지속적인 개선의 융통성 있는 절충안이 필요

## 바. 문서화(Documentation)

- 각 국가통계기관들이 통계자료 및 주요 생산과정에 대한 문서화의 중요성 인식이 증대
  - 통계품질의 보고와 함께 메타자료의 역할에 인식이 제고하고 있음
- 통계과정을 지원하는 행정과정까지 문서화의 범위를 확장시키기 위하여 TQM기법이 적용됨
- 각 기관은 문서화의 시간 및 비용의 부족으로 정보시스템과 같은 문서화 수단을 강구중임

### □ 문서화의 중요성

- 품질의 확보 및 개선을 목적으로 하는 툴
  - 다른 사람의 업무를 인계 받는 중요한 수단
  - 각 과정별 직원을 점검하는 수단
    - 직원들이 CBM이나 핸드북과 같은 책자에 있는 기준과 명세서대로 정확히 작업을 하고 있는지를 점검
  - 신규직원들의 교육용 재료
    - 신규 직원의 업무에 투입이 용이하고 직원교육에서 차질 가능 한 부분에 대한 변동부분 감소 가능
    - 동일한 종류의 신규조사에 점검표로 사용 가능
- 통계기관 내부의 품질을 개선하는 도구
  - 현재 작업을 개선하는데 기본 자료 제공
    - 작성과정 및 최종산물의 장단점을 점검
  - 품질제고를 위한 조사절차 재설계에 기본자료 제공
    - 각각 경험을 공유하고 다른 상황으로 전환시키는 기회로 활용
  - 통계기관의 완결성(completeness)을 개선하고 통계정보의 중복기 능성 배제
    - 품질의 관련성, 완결성 및 중복배제 가능
- 이용자의 자료 이해 및 이용에 활용

- 정보검색, 비교, 통계분석, 시계열분석, 연혁연구 및 통계가공에 활용가능

## □ 문서화의 문제점

- 문서화 결과의 이용자 구분 및 요구사항
  - 내부 직원 : 정기적인 조사담당 직원, 가공통계 담당직원, 관리자, 품질관리담당
  - 국제기구의 직원 : 예) Eurostat
  - 다른 기관의 직원 : 비교분석 또는 벤치마킹 목적
- 통계정보이용자 그룹
  - 일반 대중
  - 숙련된 이용자들 (공공기관 및 민간기업)
  - 전문적인 이용자들 (연구자 및 분석가)
- 문서화 대상선정(과정 및 제품의 형태 및 관련 문서화)
  - 통계 생산과정 및 통계자료 관련
    - 직접조사, 통계목적의 보고자료 이용, 혼합조사
    - 통계분석 또는 기존 자료를 이용한 새로운 자료작성
    - 문서화할 자료
      - .. 조사의 정보내용에 관한 메타자료(요구사항 평가자료, 정의 변수설정, 참조 단위 및 분류)
      - .. 생산과정에 대한 메타자료(일명 paradata) (조사실시, 조사 관리활동, 투입직원, 방법론, 사용된 소프트웨어)
      - .. 품질지표(통계자료의 품질과 관련된 양적 질적 정보)
  - 행정처리 과정관련
    - 통계작성을 지원하는 다양한 과정 자료
      - .. 예산확보 및 집행
      - .. 조사표 인쇄, 직원채용, 지역별 인사 접견, 언론기관 접촉 등

- 준수해야 할 사항들이 주로 기록되므로 체크리스트 형식 채택 가능
- 통계청 전략 및 정책
  - 사업계획 및 사명선언 내용
  - 자료제공정책
  - 품질관리정책
  - 인력개발 정책
    - .. 향후 교육계획, 승진처리과정, 급여, 직원별 책임범위
- 통계청 정책 및 통계생산의 관련성 평가
  - 직원 만족도 조사
  - 이용자 만족도 조사

## □ 문서화 내용

< 통계생산관련 >

- 조사의 일반 정보
  - 조사목적, 연혁, 지침 또는 범규정보, 조사표 설계 및 테스트 정보
- 조사표
- 변수
  - 변수이름, 변수의 근거, 코딩여부, 계산여부, 외부에서 유래여부, 통계적 특성, 레코드 길이, 조사시 상세한 정도, 측정단위, 가능학, 외부소스, 산출근거 등
- 분류
  - 참조하는 분류
  - 특정분류 채택시 텍스트 수록
  - 참조한 분류 사용시 특이한 사항 등
- 정의
  - 개념 제목, 정의 내용, 정의와 변수의 관련성 등

- 사용 방법
  - 기법, 기술
- 결과물
  - 파일이름, 저장포맷, 제공현황, 파일명세(설계, 레코드수) 등
- 품질지표
  - 품질관련 정보, 생산과정의 모니터링 자료 및 최종산출물의 품질 평가 결과 자료(Eurostat의 품질보고서)

#### < 자료제공 관련 >

- 조사표
- 변수 : 통계자료와 관련된 경우만 정리
- 분류
- 정의
- 방법론
- 결과물

#### □ 문서화 및 배포 방법

- 정보시스템에 포함되어 문서화되는 경우
  - 문서화부분이 자동으로 메타데이터베이스로 전환
    - 과정문서화 결과 일부가 모듈이 되어 이용자에게 품질에 대한 과정 및 정보를 제공하는데 쓰임
  - 문서화 일부분이 다른 문서화시스템으로 자동으로 전환

- 과정문서가 제품문서로 전환 가능

## □ 통계기관들의 문서화 방법

### < 스웨덴 통계청의 문서화 시스템 >

- SCBDOKE내용
  - 최종 조사 후 정리된 명부관리 : SCBDOKE template
  - 국가통계의 품질선언을 위한 표준화된 품질개념 및 기준
  - 표준분류 데이터베이스
  - METADOK 기준 : SCBDOKE의 컴퓨터 및 소프트웨어 버전
  - 스웨덴 통계데이터베이스의 메타자료 : MacroMeta
  - 200개 통계별 문서화기준
  - 'Facts for Statistics' 문서화 기준 : 표준화, DB화 및 컴퓨터화되어 인터넷에서 인기
  - 문서창고
  - 개인명부의 시민정보 (Personal Data Act를 따름)
  - 국가통계에 대한 품질변화 자체평가에 대한 연간조사

### < ISTAT의 문서화 시스템 >

- SIDI라는 이름의 통계조사 문서화 정보시스템 개발
  - 조사관리자의 품질관리 지원용
  - 통계생산과정의 모니터링, 통계생산과정 및 품질관리의 문서화, 총계품질에 대한 정보를 이용자 제공 등 목적으로 개발
- 메타자료의 분류
  - 조사정보(통계단위, 조사환경 등)
  - 조사계획
  - 조사실시
  - 각 과정별 품질관리
  - 조사표, 중간산물, 최종결과 등 자료 창고
  - 조사의 개편

- 품질관리를 위한 통계과정 분류
  - 프레임
  - 자료수집
  - 자료입력
  - 편집 및 임퓨테이션
  - 시의성 및 정시성
  - 비용

#### <영국 ONS의 표준 및 지침 DB >

- 대형의 Lotus Notes 참조 데이터베이스 구축
  - 전직원에게 정보 접근 제공
  - 우수한 기법 전파
  - 일관성 있는 기준 확보
  - 방법론 비교 용이

#### □ 문서화 전략수립

- 조직 내 문서화 현황 분석
- 조직운영상의 측면을 고려한 문서화
- 다른 통계기관의 경험과 우수방법을 참조 가능하도록 문서화
- 우선 순위를 선정함으로써 개선계획 수립가능

## 2. 인구동태통계

### 가. 회의 개요

#### o 목적

- 인구동태통계관련 업무의 협력, 교류를 통한 양국간의 이해증진 및 업무발전 도모

#### o 독일대표단: Ms. Bettina Sommer

#### o 회의 일정(2001년에 이어 2회째임)

- 장소: 독일 연방 통계청, 비스바덴
- 일시: 2002. 10.23(목)~24(금)

### 나. 회의 결과 주요 내용

#### o 독일측의 한·독의 인구동태통계의 작성과정 및 결과의 비교 (참고 1. 한국 및 독일의 통계협력자료 참조)

##### 1) 인구동태통계의 작성과정(독일의 인구동태통계 작성과정 참조)

- 독일과 이혼통계의 경우 법원을 통하여 작성하는 점과 사망원인통계 작성과정(병의원적극참여 포함)만이 다를 뿐, 양국의 인구동태통계 작성과정은 국민신고에 의한 것으로 대동소이

##### 2) 양국의 인구동태통계 작성결과

###### - 인구규모 및 인구동태율 비교

- 2000년 기준 독일인구는 약 2배로 독일은 자연증가율이 (-)를 보이고 있는 반면 한국은 아직도 0.7%수준의 자연증가율로 상당히 높은 수준임
- 독일의 경우 출생률 및 사망률이 낮은 수준에서 정체하고 있으나 한국의 경우 사망률은 안정적인 수준을 보이고 있지만 출생

률의 급격한 감소로 자연증가율이 급격히 감소되어 짧은 기간 내에 독일 수준으로 접근될 것으로 추정됨

#### - 인구 피라밋의 비교

- 독일의 경우 1970년 이후 상당히 낮은 출산율 지속으로 저연령층이 크게 줄어든 반면, 한국의 경우 1980년 중반이후 급격한 출생아 수 감소를 반영하여 저연령층이 현저히 줄어들고 있는 것을 볼 수 있으며, 우리나라의 2010년경 인구피라밋 형태를 보임\

#### - 평균수명의 비교

- 독일의 평균수명은 남녀 모두 높으며 남자는 4년, 여자는 2년 정도의 차이로 남자의 평균수명에서 더 많은 차이를 보이고 있음. 다만 우리나라의 평균수명 증가속도를 감안할 경우 상당히 짧은기간내 독일수준에 도달될 것으로 전망됨

#### - 혼인율의 비교

- 독일측의 혼인율이 상당히 낮으며 특히 통독이후 급격한 감소세에서 최근 들어 다소의 안정을 보이고 있음. 최근 들어 한국의 경우 혼인율이 지속적으로 낮아지고 있으며, 이는 최근 출생률 감소에 큰 영향을 주고 있는 것임
- 출생율과 관련하여 양국의 혼인율을 직접 비교하는 것은 양국의 사실혼 차이와 관련된 부문이 있을 수 있다고 사료됨(독일의 출생의 경우 총출생의 40% 정도가 사실혼 관계의 출생임)

#### - 이혼율의 비교

- 최근 한국의 이혼율이 급격히 증가하여 오히려 독일의 이혼율보다 높은 것을 나타남
- 혼인과 마찬가지로 사실혼 현황과 관련해 볼때 직접비교는 불가능한 것임

#### - 남녀의 평균 초혼연령의 비교

- 남녀 모두 독일의 초혼연령이 높게 나타나고 있으나, 사실혼과 관련된 문제가 있어 직접 비교는 불가능하나, 독일 남자는 30세가 넘고

있으나, 특히 여자는 아직도 30세 이하를 보이고 있음

### ○ 우리나라의 인구현황 설명(붙임 자료 참조)

- 우리나라의 인구규모 및 연령별 인구구조
  - 총인구 및 연령별 인구의 변화
- 주요 인구의 당면과제
  - 인구고령화, 수도권의 인구집중 심화
  - 40~50대 남녀의 높은 사망률비
  - 탈 가족화 현상 등

### ○ 양국 합의내용 및 향후 협력방향

- 양국의 인구동태통계 비교에 관한 최종보고서 발간 준비
  - 인구동태통계에 관한 정의 비교
  - 다양한 인구지표의 비교를 위한 상호 데이터 보완
- 급격한 한국의 인구변화에 대한 전망자료 추가 보완
- 최종 보고서 작성 및 발간을 위한 최대한 상호협조
  - 양국 통계청의 기관저널 수록 검토
  - 2003년 ISI에 공동발표 등

### ○ 주요 질의 및 응답내용

#### 1) 생명표와 관련하여

- 생명표작성 및 고연령층의 사망률 보정은
  - 매년 작성하되 3개년 자료의 평균치를 이용하여 작성
  - 90세 이상의 사망률이 너무 높아 90세이상을 상한연령으로 작성

- 지역별 생명표는 주정부 통계청에서 직접 작성

## 2) 인구추계프로그램

- 독일 인구추계작업 세부 지침서를 제공해줌(전산프로그램개발용)

## 3) 지역별 추계에서

- 지역간 인구이동에 대한 장래 예측과 관련하여 주정부간의 조정 불가피

## 4) 주정부의 인구동태 및 인구이동에 등에 관한 현장 방문

- 출생, 사망, 혼인, 이혼 및 인구이동에 관한 전산시스템이 개발되어 현재 운영 정착중임
- 신고서자체가 인터넷 신고가능인 경우와 아직도 신고서의 입력이 병행중에 있음  
다만, 입력비중은 6%수준으로 상당히 낮은데, 0% 달성을 위한 노력중이라고 설명
- 담당자는 세부적으로 할당된 자기업무를 중심으로 세밀하게 자료 내용을 확인하여 처리하는 것이 인상적임
- 주정부 통계청에서는 인구통계 등 주정부내 모든 분야의 통계를 직접 작성하고, 이를 연방 통계청에서 취합 방식

## 5) 인구추계 작업중 출산력 장래 변동에 관한 가정 설정은

- 최근 30년간 합계출산율 수준이 큰 변화가 없으며, EU에서 권장하는 가정설정방식을 채택하고 있음
- 한국의 경우 최근 급격히 감소하는 합계출산율 수준은 일정기간 이내에 최소한 현재 독일수준인 1.4 수준으로 다시 회복할 것으로 전망의견을 피력(1970년 이후 지속된 수준임)
- 밀레니엄 베이비 현상이 독일에도 있는지?

- ⇒ 독일에서도 있을 것으로 기대했었는데 실제로는 나타나지 않았음
- 쌍둥이 출산은 어느 정도인가?  
⇒ 총출생아의 3.1%, 산모기준으로는 1.6% 수준임  
⇒ 쌍둥이이상에서 사산, 출생 등 구분하여 통계작성함

## ○ 독일에 관련된 내용들 요약

- 1) 독일 장래인구 추계결과
  - 90년도 합계출산율이 급격히 떨어졌으나(특히 구동독) 출산장려정책은 고려하지 않고 있음
  - 독일인구추계의 출산력 가정을 보면 최근수준이 지속되는 것으로 되어 있는데 이에대한 의견은 어떤가?  
⇒ 지난 30년간 현재수준이 지속된 것으로 보아 향후에도 현재수준이 될 것이라고 가정
  - 연금정책에 반영하기 위하여 작년에 추계인구 작성함  
⇒ 2050년에 예상되는 독일인구는 6500만~7000만으로 예상됨
  - 최근의 인구센서스가 14년 전에 실시 되었다고 하는데, 모든 인구산출의 기초가 되는 인구센서스 그 자체의 오차는 어떻게 해결하는지?  
※ 인구센서스는 현재인구, micro-census 인구동태통계의 기본자료로 활용  
⇒ 센서스 결과는 검토를 충분히 거친 수치임. 외국으로의 이주, 이민 등의 경우는 오차가 클 수 있으나 그 외에는 신빙성 있음
- 2) 통일에 따른 인구통계의 문제점 및 통합과정
  - 독일은 통계역사가 길어(인구동태통계작성은 1875년이후 계속) 기본적으로 동·서독간의 차이가 크지 않았음
  - 그러나 분단 45년간 다른 체제 속에서 분리 운영되었으므로 다소 차이와 문제점도 발생함

## - 동독 인구통계작성의 문제점

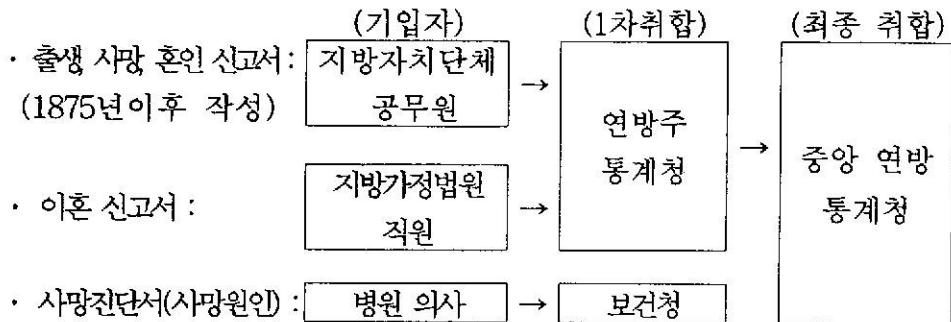
- 사회주의와 자본주의 체제하의 가족개념, 평가방법, 결과산출 등이 상이
- 영아사망률은 구동독이 구서독보다 높아지자 구동독에서 의도적인 조정작업을 실시
- 자살통계는 구동독에서는 의도적으로 적게 파악
- 통독이전 동독의 외국인 수(아프리카, 베트남 노동자 등)가 제대로 파악되지 않았음
- 구동독을 탈출한 인구가 구동독인구에 포함되어 있었음

## - 통합과정

- 통일당시 구동독의 통계시스템은 구 서독의 통계시스템에 따른다고 법으로 공포(1990.10. 2 내무성)
- 1990년에는 혼합된 형태로 통계작성
- 1991년이후에는 서독의 통계시스템 형태로 전환
  - .. 구동독을 무단 탈출한자(1989~90)의 인구가 동독인구에 포함되어 있어(약 70만명) 통일후 통독이전 동독을 탈출한 사람을 파악하여 중복된 인구를 제거(약 1~2년 소요)
  - .. 1992년이후에는 서독의 통계시스템으로 정착  
※ 동독인의 서독제도 적극적 수용자세로 큰 문제 없었음
- 통독이후 인구통계의 변화상
  - .. 구 동독 주민이 자본주의에 대한 기대심리가 깨지기 시작(실업 등) 하여 결혼건수가 급격히 감소하였고 이와 동시에 출생 아수는 급감, 젊은층의 사망자수가(사고사) 급격히 증가
  - .. 통독이전 동독의 경우 70년이후 출산장려책에 힘입어 합계출산율이 서독보다 월등이 높았으나 통독이후 급격히 낮아짐
  - .. 통일이전 동독은 결혼연령 및 첫 출산 연령이 젊었으나, 통독이후 양상이 바뀌어 결혼연령 및 첫 출산 연령이 늦어지고 있음

## < 독일 인구동태통계 작성과정 >

### ○ 작성체계



- 연방주의적 통계제도임. 모든 통계조사는 연방주 통계청에서 이루어지고 중앙통계청은 취합하여 독일전체 통계를 작성함
  - 연방주 통계청에서 누락이나 부실기재사항 내용점검을 다 한후 중앙연방 통계청으로 보냄
  - 부실자료는 동태당사자가 아닌 지방자치단체 담당공무원(관청) 및 가정법원, 의사에게 전화질의하여 보완함
- 지방자치단체에 출생, 사망, 혼인을 담당하는 관청이 있음
  - 신고서를 개인이 아니라 담당 관청 직원이 작성
  - 혼인의 경우 지방관청에서 먼저 혼인선포식을 하고난후 혼인 서약해준 관리가 혼인신고서를 작성
    - \* 이후 교회등에서 추가로 결혼식 거행하기로 함
- 사망신고와 사망원인신고 분리 운영
  - 사망신고서는 지방자치단체, 사망진단서(사망원인)는 의사가 기재 발부해서 보건청을 통해서 연방주통계청에 모아져서 통계를 작성
  - 이혼은 가정법원에서 담당하고 있음

### ○ 자료입력

- 전산으로 입력하여 입력한 자료를 제출(우리나라와 유사)

○ 사망원인통계

- 사망원인 코딩은 연방주통계청에서 하고 있음
- 사망원인 자동코딩 시스템 도입 검토중
  - 미국등의 시스템을 독일 실정에 맞게 도입 추진하려고 하는데 3~4년 정도 더 소요될 것으로 보임

※ Eurostat에서 유럽국가들의 자동코드화 상태 조사한 자료 제공

## ○ 인구동태신고서 항목

출 생	사 망	혼 인	이 혼
신고년월	신고년월	신고년월	접수기관(법원)
신고장소(기관)	성 별	접수기관명	별거기간
모의 상주지	사망년월일	남편·처 주소	이혼종류
외국인인 경우 국적	출생년월일	결혼년월일	남편·처 출생년월일
출생-사산구분	영아사망여부구분	남편·처 출생년월일	결혼년월일
출생아 성별	생존기간	현결혼직전 혼인상태	18세 이하자녀수
출생년월일	혼인상태	남편·처의 종교	법적유효일
단태아-다태아	종 교	남편·처의 국적	부부의 국적
혼인중·외자	국 적	전자녀수 및 혼 인외의 자녀수	
부모결혼년월일	사망원인		
현결혼 출산순위	영아사망의 경우 출생시 체중, 신장		
현결혼 사산아수			
직전 출산년월일			
부모 출생년월일			
부모 종교			
부모 국적			
모의 경제활동여부			
출생아 체중			
출생아 신장			
모의 주된상주지			

## ○ 독일의 인구동태통계 작성과정의 주요 특징

### - 출생(신고기일: 3일)

- 쌍둥이 출산모의 구성비, 총 출생아에 대한 구성비
- 출산순위는 현재의 남편을 기준으로 작성
- 신고의무자가 의사, 출산관련자, 부모순으로 대부분 병원출산이므로 병원에서 신고

### - 사망(신고기일: 3일)

- 화장 뿐만 아니라 매장을 할때도 반드시 사망진단서가 있어야함  
※ 매장인 경우도 공원매장등 사망진단서가 반드시 필요  
(개인매장 없음)
- 신고기간내 신고하지 않는 경우 벌금이 부과되나, 즉시 신고하지 않으면 의심을 받기 때문에 즉시 신고가 정착됨(∴ 영아사망신고도 정확)
- 영아사망의 경우 생존기간 자세히 파악함(1일이내는 생존시간을 파악)
- 혼인상태별 사망→혼인상태별 추계인구에 반영

### - 혼인

- 혼인선포식에 참여한 담당공무원이 혼인신고의무자이므로, 내용이 정확하고 신고 누락이 없음  
※ 관청에서 관리참여하에 혼인서약 등 혼인선포식 거행이 우선 절차이며 추가로 교회등에서 다시 결혼식 거행
- 혼인전 자녀수(혼인외의 자녀수) 파악

### - 이혼

- 이혼은 전적으로 가정법원에서 담당함으로 법원으로부터 자료받아 처리

참고 1. 한국 및 독일의 통계협력자료

참고 2. 우리나라의 인구현황

## < 수집자료 목록>

- 독일 장래인구추계 보고서(2000년기준 2050년까지)
- 인구추계작업 세부 지침서(전산프로그램 개발관련)
- 인구동태(출생·사망·혼인·이혼)신고서 양식
- Eurostat Working Papers 책자

## 3. 환경경제계정

### 가. 회의 개요

- 목적
  - 환경경제계정관련 업무의 협력, 교류를 통한 양국 간의 이해증진 및 업무발전 도모
    - 환경효율성 비교에 관한 양국의 공동 연구프로젝트 진행사항 프리젠테이션
    - 프로젝트상의 문제점 토의 및 향후계획 논의
- 독일 대표단: Dr. Schoer(환경계정과장), Mr. Schweinert

### 나. 회의결과 주요내용

- 독일측의 양국의 환경효율성 비교에 관한 한·독 협력프로젝트 잠정결과분석 프리젠테이션 (참고 1. 양국의 공동프로젝트 잠정결과 프리젠테이션 자료 참조)

## 1) 서론 : 환경효율성이란 무엇인가?

- 환경효율성(Eco-efficiency)은 환경자원이 인간의 욕구를 충족시키기 위해 사용됨에 따라 나타나는 것으로,

- 경제활동에 의해 발생된 환경오염물질을 국내총생산(GDP)과 대비함으로써 효율성을 측정 ( $GDP /$ 환경오염물질)

※ 자료: World Business Council for Sustainable Development(WBCSD)

- 양국은 WBCSD의 환경효율성 정의에 따라 양국의 경제 및 환경 지표를 비교키로 함

- 환경효율성은 경제성장으로부터 환경압력의 완화를 측정할 수 있는 환경지표(Environmental Indicators to measure decoupling of environmental pressure from economic growth)로 나타낼 수 있는데, 이는 소위 'De-coupling Indicators'로 칭함

※ De-coupling지표는 2001년 5월 OECD 환경각료회의에서 회원국의 환경 성과(environmental performance)를 측정할 수 있는 지표 개발의 요청에 따라 OECD는 지표 개발을着手하여 De-coupling Indicators의 개념을 제시

- De-coupling은 경제성장과 환경관련 요소와의 관계에서 측정 가능
    - 예를 들어, 이산화탄소 배출량을 GDP 성장을과 비교함으로써 경제성장으로부터의 환경압력의 완화정도를 측정할 수 있음

- Decoupling Indicators는 경제성장에 따른 거시 및 부문(sectors) 수준에서의 지속가능 발전 정도를 보여줄 수 있으며, 또한 환경 경제계정 구축의 구성요소를 위한 유용성을 지닌 도구로서의 기능을 지님

- 'Strong decoupling' : GDP 성장을에 비해 환경오염 배출율이

낮아 경제성장률이 긍정적으로 작용하는 현상으로, 예를 들면, 최근 오존층파괴의 주범인 염화불화탄소 사용량은 GDP 성장률에 비해 급격히 줄어들고 있음

- 'Weak decoupling' : GDP 성장률에 비해 환경오염 배출율이 높아 경제성장률이 부정적으로 작용하는 현상으로, 예를 들면, 최근 에너지, 용수 및 자연자원 사용량의 증가율은 GDP 성장률에 비해 높게 나타나고 있음

## 2) 본론 : 경제구조와 환경오염배출량과의 비교

### □ 경제(Economy)와 환경요소(environmental factors)간의 양국 비교

- 경제활동을 위해 사용된 환경요소의 양국 지표 비교(1991년 대비 1999년)
  - 독일의 경우 환경관련 요소들의 투입이 1991년에 비하여 1999년이 전체적으로 감소하는 추세임
    - 이는 경제성장률의 증가율에 비해 환경관련 요소들의 투입율이 낮아지고 있다는 것을 의미
  - 반면, 한국의 경우 메탄, 산성화가스(이산화황과 질소산화물) 및 일산화탄소의 경우는 감소추세를 보이나, 1차 에너지소비, 용수사용량, 온실가스, 토지 이용율은 증가추세임
    - 따라서 한국의 경우 높은 경제성장은 환경압력에 의한 결과 도출

#### ※ 도표 Use of environmental factors for economic purposes 참조

- 양국의 경제활동별(산업 및 가계) 이산화탄소 산업별 구성비는 유사
  - 독일 : 산업(75%), 가계(25%)

- 한국 : 산업(83%), 가계(17%)

## □ 산업별 부가가치 대비 이산화탄소 배출량 비교

- 양국에 있어 전력·가스업이 부가가치 산출액에 비해 이산화탄소의 배출량이 가장 높은 업종으로 나타남
  - 다음으로는 1차 금속업, 광업 등의 순임
    - 이는 경제활동과정에서 산출된 부가가치 단위당 얼마나 이산화탄소배출이 이루어지는가를 나타냄
  - 1991년을 1999년과 비교하여 보면, 독일의 경우 광업을 제외한 전업종에서 부가가치 단위당 이산화탄소 배출량이 감소하고 있지만, 한국의 경우 직물업, 화학산업, 조립금속업 등의 업종에서는 매우 높은 증가세를 보임
- 결론적으로 경제구조와 이산화탄소배출량의 관계를 보면, 독일의 경우 거의 전 업종에서 해를 거듭할수록 이산화탄소의 배출량이 감소하지만, 한국의 경우는 일관성을 갖지 못한 결과가 도출

### 3) 결론

- GDP/환경투입요소의 결과 독일은 생산성이 높게 나타나고, 한국은 생산성이 낮게 나타남
  - 이는 경제활동의 결과 발생한 환경오염배출량이 독일의 경우는 점차 낮아지고 있는데 반하여 한국의 경우는 높아가고 있음을 의미
- 업종별 구조를 보면 독일의 경우 일관성 있게 전 업종에 있어 배출량이 감소하고 있지만, 한국의 경우는 일관성이 없음

## 다. 주요 논의 사항

- 프로젝트 진행상에서 나타나는 데이터의 문제점 및 보완 논의
  - 토지이용(Built up and traffic area)
    - 양국간의 토지이용 범위에 대한 세밀한 검토가 필요함에 따라 독일측의 정의를 기준으로 한국 데이터를 재검토하기로 함
  - 수자원과 폐수
    - 한국의 수자원 총량 및 폐수총량의 차이가 많은데, 이는 수자원 통계는 건설교통부, 폐수 통계는 환경부에서 작성 및 추계함으로써 일차적으로 데이터의 일관성과 추계방법의 불명확 ⇒ 따라서 수자원통계 작성과정과 구성요소를 재검토키로 함
  - 이산화탄소
    - 수송분야에서 이산화탄소 배출량이 산업 및 가계에 적절하게 배분되었는지 재검토 요망
  - 메탄
    - 메탄 감소의 2가지 주요원인이 폐기물산업의 폐기물을 처리기술 발달과 농업재배 면적의 감소가 맞는지 재확인 요청

## ○ 향후계획

- 프로젝트는 실질적으로 금년 12월중에 완료하며, 출판과 관련한 사항은 2003년 상반기에 마무리
  - 한국통계청은 12월내로 데이터의 최종점검을, 독일통계청은 최종분석을 담당
  - 단, 프로젝트 서론 기술은 한국통계청이 맡기로 합의
- 출판은 양 기관의 저널에 영문으로 수록 검토하며, 영문 체크는

## 한국통계청 국제통계과의 외국 자문관에게 협조 구하기로 함

### < 한·독 공동 연구프로젝트 배경 및 범위>

#### □ 배경 및 목적

- 2001년 8월 대전에서 개최된 한·독협력 회의시 양국간 환경영제 계정 구축에 관한 방법론에 대하여 많은 정보교환과 토론이 있었으며, 향후 이에 관한 협력의 필요성이 제기되었음
  - 이에 따라 양국은 독일통계청의 환경영제계정 작성결과의 토대 위에서 양국의 환경과 경제의 비교 분석에 관한 프로젝트를 수행하기로 합의
    - 프로젝트 수행의 목적은,
- 1) UN의 'NEW SEEA 2000(System of Environmental Economic Accounts 2000)'에서 권고하고 있는 개념을 바탕으로 환경효율성 지표에 관한 통계의 비교를 통하여
- 2) 양국의 경제성과에 따른 환경상태를 분석하는 것임
- 환경问题是 국내문제에만 국한되지 않고, 이제는 전지구적인 문제로 대두됨에 따라 대표적인 세계 주요 경제대국인 독일과 대표적인 신흥공업국가인 한국과의 경제성장에 따른 환경상태의 비교는 매우 유용할 수 있음

#### □ 자료

- 통계자료는 이미 공식적으로 발표하고 있는 독일환경경제계정 (German Economic Environment Accounts, GEEA)의 주요 지표 (경제, 에너지, 환경관련)를 기준으로 한국의 지표를 총괄지표 및 경제활동별로 분류

## □ 분석(Analysis)

- 분석기간 : 1991~1999
- 분석내용
  - 일반적인 경제발전 비교
    - GDP, 고정자본소모, 고용시간 등
  - 환경효율성(GDP/환경압력지표) 비교
    - 환경압력지표: 에너지, 용수 사용량, 이산화탄소 배출량, 산성화 가스(이산화황, 질소산화물), 폐기물, 토지이용(주택 및 도로이용)
  - 경제구조(Economic structure)와 환경과의 비교
    - 산업별에 따라 환경영향정도(에너지사용, 용수사용, 이산화탄소 배출, 폐기물발생, 토지이용 등) 분석
    - 한국의 경우 산업별 분류가 가능한 지표를 우선적으로 작성

< 경제 및 환경관련 지표 >

Specification	Units	1990 1991 1992 1993 1994 1995 1996 1997 1998 1999
Production factors		
Primary Energy consumption	Petajoule	
Water extraction from nature	Mill.m3	
Greenhouse gases	Mill.t	
thereof: carbondioxide	Mill.t	
Acidification gases	Mill.t	
Water disposal into nature	Mill.m3	
therof: waste water	Mill.m3	
Built up and traffic area	Km2	
Hours worked	Mill.hrs.	
Capital consumption (at 1995 prices)	Bil.\$	
Memorandum item:		
Gross domestic product (at 1995 prices)	Bil.\$	
Production factors(1991 respectively 1993=100)		
Primary Energy consumption	-	
Water extraction from nature	-	
Greenhouse gases	-	
thereof: carbondioxide	-	
Acidification gases	-	
Water disposal into nature	-	
therof: waste water	-	
Built up and traffic area	-	
Hours worked	-	
Capital consumption (at 1995 prices)	-	
Primary Energy consumption	-	
Water extraction from nature	-	
Greenhouse gases	-	
thereof: carbondioxide	-	
Acidification gases	-	
Water disposal into nature	-	
therof: waste water	-	
Built up and traffic area	-	
Hours worked	-	
Capital consumption (at 1995 prices)	-	
GDP in relation to production factors(1991 respectively 1993=100)		

참고 < UN의 2000 환경경제계정(SEEA) 체계와 독일의 환경경제  
계정 체계 >

## 1. UN SEEA 2000

### □ SEEA의 작성 배경

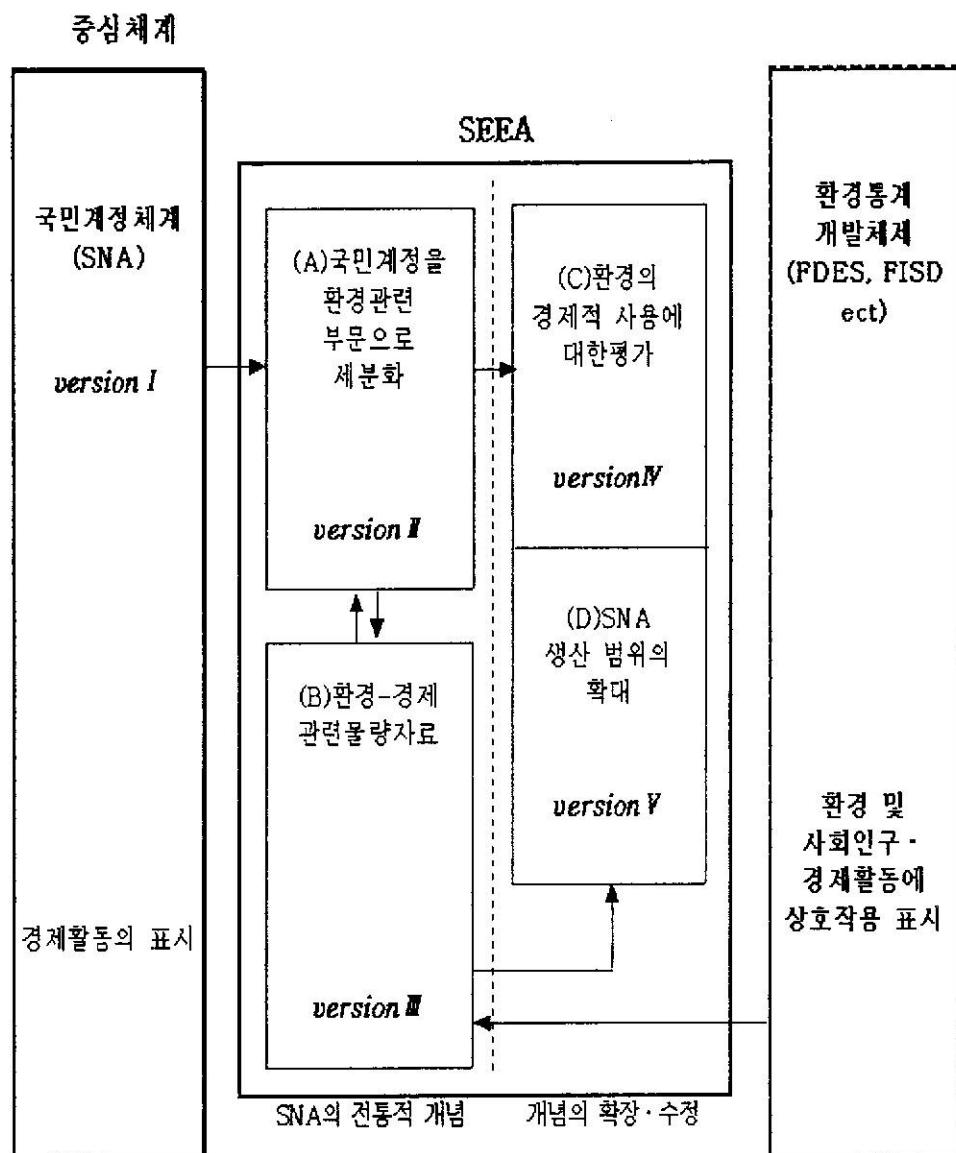
- 환경문제에 대한 인식은 1972년 로마클럽의 보고서 “성장의 한계”와 중동의 오일 쇼크 이후 전 세계적인 관심사로 부각되었음
  - 본격적으로는 1992년 브라질 리우 세계 정상회의에서 환경과 경제성장이 동시에 고려되어야 한다는 소위 “지속가능한 발전(sustainable development)” 개념이 각국의 환경 및 경제정책의 주요 고려사항이 되었음
- ※ 지속가능 발전 : “미래세대의 필요를 충족시킬 수 있는 능력에 손상을 주지 않으면서 현세대의 필요를 충족시키는 발전”(sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs, 세계환경개발위원회, 1987)
- SEEA는 환경과 경제가 통합된 계정으로서 환경과 경제가 상생하는 정책 수립을 위한 기초자료로 활용하기 위하여 개발되고 있음

### □ SEEA의 작성단계

- SEEA의 작성단계는 SNA의 개념과 체계를 점진적으로 확장해 가는 5개 단계의 버전으로 구성되어 있음  
⇒ SEEA의 작성단계 (그림 1 참조)
  - 버전 I : SEEA의 중심체계로 SNA의 공급 및 사용계정과 자산계정을 재구성(광물, 임목, 토지 등 비생산 자연자산)함으로써 환경과 관련된 경제활동을 나타냄
  - 버전II : 버전 I의 공급 및 사용표와 비금융 자산계정에서 환경관련 flow 및 stock을 SNA 체계 내에서 분리

- 버전Ⅲ : 경제활동에 의해서 발생되는 오염배출량을 나타내는 오염물질계정과 자연자원손실을 나타내는 자연자원계정의 작성
- 버전Ⅳ : 자연자산의 화폐적 가치와 동 자산의 사용에 따른 귀속비용을 추정하기 위한 3가지의 평가법이 이용되며, 이러한 평가결과로 환경조정지표들이 작성됨
  - 1) SNA 비금융자산계정 평가원칙에 의한 시장평가법(market valuation)
  - 2) 자연자산의 현재수준을 유지하기 위한 필요 비용을 추정하는 유지비용평가법(maintenance valuation)
  - 3) 환경으로부터 제공되는 서비스의 손실가치를 추정하기 위한 가상적 평가법(contingent & related demand-side valuations)
- 버전V: SNA의 생산범주를 다음까지 확장함
  - 가계의 생산활동
  - 토지가 제공하는 공간적 서비스와 환경의 쾌적함 등과 같은 환경서비스를 자연환경의 생산활동으로 간주
- 현재 우리청에서 개발중인 환경오염배출량통계는 Version Ⅲ에 해당
- 환경·경제계정인 SEEA가 구축되면 거시경제정책 정책 및 자원관리 등의 평가를 위한 국민계정을 보완 할 수 있게 되며 다음과 같은 정책적 적용에 사용될 수 있음
  - 재정정책(Fiscal policy)
  - 환경규제(Environmental regulations)
  - 자원이용관리(Resource Use Management)
  - 환경정책(Environmental policy)
  - 환경위험조절(Environmental Damage Control)

<그림 1> 환경경제통합계정(SEEA)의 작성 단계



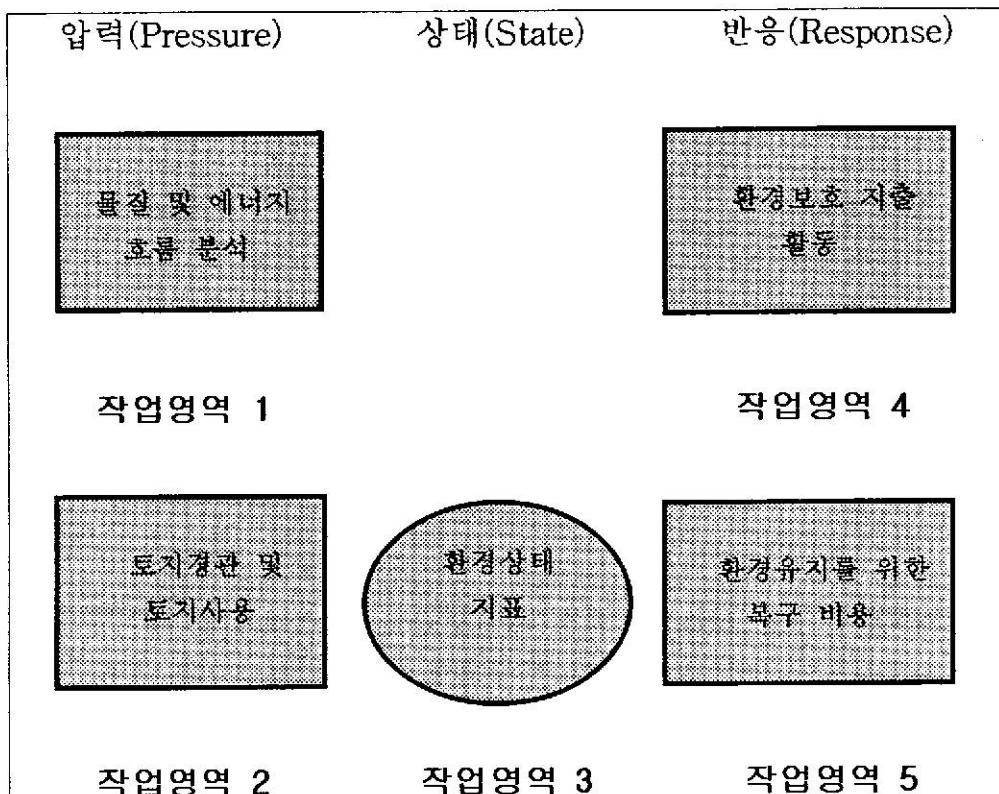
출처: 유엔통계국(UNSD), System of Environmental and Economic Accounts, 1999

## 2. 독일의 환경경제계정 체계

- 독일의 환경계정은 80년대 말부터 연구가 시작되었으며, 98년부터 매년 공식적으로 발표되고 있음
  - 최근의 환경경제계정 체계는 UN의 환경경제계정(SEEA) 체계에 따라 작성하고 있음
- 독일의 환경계정체계는 압력(Pressure)-상태(State)-반응(Response) 체계에 따라 5개 작업 영역으로 분할되고 있음:  
⇒ 독일의 환경경제계정 영역 (그림 2 참조)
  - <작업영역 1>은 경제활동으로 발생되는 대기오염물질, 폐수, 폐기물 등의 발생에 관한 물질 및 에너지 흐름 계정(Material and Energy Flow Accounting) 임
  - <작업영역 2>는 토지이용으로 인한 무형의(immaterial) 환경압력과 관련된 계정으로, 이를 위해서는 지리정보시스템(GIS)이 방법론적 수단으로 이용됨
  - <작업영역 3>은 환경상태에 관한 물적지표(physical indicators)로 다음의 계정이 시험 연구 중임
    - 토지경관(landscape)과 생태시스템(ecosystem)의 환경의 질 등에 관한 계정
    - 기타 대기, 지하수 등과 같은 자연시스템에 관한 연구
  - <작업영역 4>는 환경오염방지 및 시설투자와 관련된 환경보호지출계정과 환경오염의 발생을 억제시키기 위한 경제적 수단인 환경세에 대한 작업 영역임
  - <작업영역 5>는 오염 또는 훼손된 환경을 표준상태로 회복하기 위하여 소요되는 비용을 산출하는 계정으로 현재 연구 중임

- 전 영역에 걸친 환경경제계정 작업은 현재까지 이루어지지 않고 있으며, 다만 개별 영역의 작업이 이루어지고 있음

< 그림 2 > 독일의 환경경제계정 영역



<작업영역 1 > 물질 및 에너지 흐름계정(MEFA : Material and Energy Flow Accounting)

- MEFA의 작성 목적은 경제활동을 위하여 필요한 자연자원, 원료 등의 투입과 경제활동에 의해서 발생하는 대기오염물질, 폐수, 폐기물 등의 상호 관계를 파악하기 위한 계정임
  - MEFA는 독일 연방정부의 경제 및 환경정책 수립을 위한 기초자료 제공에 있음
  - 최근 “지속 가능한 발전 정책(sustainable development policy)”

수립을 위한 기초자료로서 에너지, 원자재, 토지사용, 용수사용 등의 사용에 따른 오염물질의 발생량 변화를 국민계정의 GDP, 총고정자본형성 및 고용 등과 비교·분석

### ○ MEFA의 구조

- MEFA는 경제활동별(산업, 가계), 오염물질별로 작성

투입(Input) ⇒	경제활동 ⇒	산출(Output)
<ul style="list-style-type: none"> <li>○ 국내(domestic)           <ul style="list-style-type: none"> <li>- 원료(materials)</li> <li>- 용수(water)</li> <li>- 에너지(energy)</li> <li>- 토지</li> </ul> </li> </ul>		<ul style="list-style-type: none"> <li>○ 배출량           <ul style="list-style-type: none"> <li>- 대기오염물질</li> <li>- 폐기물</li> <li>- 폐수</li> <li>- 토지 질의 저하</li> </ul> </li> </ul>

- MEFA의 주요 하부계정으로 대기오염계정, 수질계정, 폐기물계정, 등이 있으며, 80년대 말부터 연구되어 98년에 처음으로 공식 작성 되었음
  - 대기오염계정은 에너지 사용용도 (산업, 난방, 수송, 발전)에 따라 경제활동별 오염물질 배출량 작성
    - 대기오염계정 작성을 위해서는 기본적으로 에너지 사용량 및 에너지 종류별 오염물질 배출계수가 필요
    - 오염물질 배출량은 환경문제별(지구온난화: 이산화탄소, 메탄, 아산화질소, 산성화: 질소산화물, 이산화황), 경제활동별로 작성
  - 수질계정은 독일 전체 용수사용량(생활용수, 공업용수, 지하수, 증발량 등)의 투입에 따른 경제활동별 폐수 배출량 작성
    - 프랑스, 호주, 캐나다 등의 국가에서는 수자원계정과 폐수계정으로 이원화하여 작성하고 있는 데에 반해, 독일의 수질계정은 수자원계정과 폐수계정을 일원화하여 작성하고 있음

- 폐기물계정은 원료의 사용에 따른 폐기물의 발생을 처리형태별(매립, 소각, 재활용), 경제활동별로 작성
  - 특히 최근 급격히 증가하고 있는 포장폐기물 및 재활용 품목에 대한 세부 계정 작성에 주력하고 있음

## <작업영역 2 > 토지경관 및 토지이용

- 국민계정상의 토지는 소유주체에게 경제적 이득을 제공하는 비생산 경제자산이며 국민대차대조표의 중요한 부분을 차지함
- 환경경제계정상의 토지의 경제적 사용은 장·단기적으로 악화 또는 개선과 관련됨
  - 도시개발 및 경제적 목적으로 도로의 확장, 주택의 건설, 공장의 건설 등은 토지면적의 감소를 가져옴
  - 유독물, 산성화 등에 의한 토양오염 및 토지 질의 저하를 가져오며 레크레이션, 농업용지 등을 위한 미개간지(습지, 처녀림)의 개발은 생태계 균형을 파괴
- 지리정보시스템(GIS)를 이용하여 관측한 자료를 이용하여 토지경관(land cover) 및 토지이용(land use)을 용도별(공장용지, 도로, 주택 등)로 구분하여 작성
  - 토지계정은 경제성장(공장용지, 도로 및 주택의 증가)에 따른 토지의 질적 저하에 대한 분석과 토지·환경 및 경제정책수립 등에 매우 유용하게 활용 됨

### <그림 3> 토지계정 구조

토 지 경 관 (Land cover)	토 지 이 용(Land use)					
	도시 및 주택 건 설	도로 및 기타 네트워크	농업용 토지	미개간지 개발	휴양용 토지	기타 토지
지상 생태계	○ 산림					
	○ 습지					
	○ 저산대 지역					
	○ 대초원					
	○ 툰드라					
	○ 기타 지상 생태계					
	- 농촌 생태계					
	- 도시 생태계					
해양 생태계	○ 해양					
	○ 연안					
	○ 강					
	○ 호수					
	○ 기타					

- 토지이용(Land use) 계정은 용도별, 경제활동별(산업, 가계)로 작성

### <작업영역 3 > 환경상태지표

- 자연 풍경(landscape) 및 생태시스템 등에 관련된 지표로서 주로 모니터링에 의해 측정되는 지표로 연방 과학기술청, 환경청, 보건 청 등 관련기관에서 측정되어 연방통계청과 협력하여 작성
  - 현재 이에 대한 작업은 시험 연구 상태며, 타 다른 작업 영역에 비해 자연과학적 및 공학적 기법이 많이 요구되어 계정 작성 영 역 중 우선순위가 낮음

#### <작업영역 4 > 환경보호지출 활동

- 이 부문은 환경경제계정 영역 중에서 가장 먼저 개발되고 작성된 부문으로 1970년대 중반부터 작성되고 있음
  - 본 작업영역은 환경보호지출계정과 환경세로 구성되어 있음
  - 환경보호지출 계정은 오염매체별(대기, 수질, 폐기물, 소음·진동) 오염방지·감소 등을 위한 총고정자본형성 투자 및 비용지출에 관한 계정이며, 경제활동별, 오염방지지출 형태로 작성
    - 경제활동별 환경보호지출계정 및 환경세의 기초조사는 연방통계청 사회통계국 환경통계과에서 작성하고 있음
- 기업에 대한 환경세는 산업별로 작성

#### <작업영역 5 > 환경유지를 위한 복구비용통계 연구

- 복구비용 통계 작성을 위한 화폐가치화는 독일 부퍼탈 에너지 및 환경연구소 및 오스나 부뤼肯 대학과 공동으로 대기오염물질에 대하여 2000년에 시험작성 한 바 있음
  - 그러나 화폐가치화를 위한 이론적 방법론의 국제적 합의가 이루어지지 않고 있어 공식적 작성은 하지 못하고 있음
- ※ 현재 2000년 SEEA 매뉴얼에서도 화폐가치화에 대하여 소개는 하고 있으나, 아직까지 공식적으로 작성하고 있는 국가는 없음

## 부 록

1. 참고자료(영문)

2. 수집자료(영문)

# **Quality Management at NSO Korea**

25 October 2002

Sulhee Kim  
Quality Management Team, KNSO

## **Contents**

- **History of Quality Management at KNSO**
- **Basic Strategies of Quality Management**
- **Quality Assessment Indicators Framework**
- **Quality Assessment process**
- **Feedback of Assessment Results**
- **Conclusion**

## **History of Quality Management at KNSO**

- **Study on Quality Management at NSO**  
**launched : May 1999**
  
- **A taskforce at Planning Division**
  - Collect relevant references
  - Examine the previous examples of other NSIs
  - Train staffs as quality evaluators

## **Quality Assessment Framework**

- **Not easy to measure the status of statistics quality**
  - Need of a standardized scale
- **Several previous instances for such a case**
  - Quality Guidelines (Statistics Canada), European Foundation for Quality Management(ESS), Quality Assessment Framework (IMF) & Statistical Quality Checklist (ONS UK)
- **A draft of quality assessment framework (late 2000)**
  - Experimental application
    - Consumer Price Index, Economically Active Population Survey
  - Finding of some problems
    - Make indicators easy to measure
    - Objectivity & comparability of assessment results

## **The Statistical Quality Seminar 2000**

- **The Statistical Quality Seminar held in Korea**
  - Cosponsored by IMF & KNSO
  - 45 experts from 8 countries & 7 international organizations
- **Exchanged expertise and experiences in statistical quality assessment and improvement**
  - Quality dimensions
  - Social and political context by statistical organizations.
  - National experiences in quality management
    - Trial version of quality framework of KNSO introduced

## **A Fact-Finding Survey of Official Statistics**

- **KNSO experienced difficulties in late 2001**
  - Due to accidental mistake of making figures in a press release
- **Take this opportunity to examine the quality status of official statistics in Korea**
  - 227 individual statistics by 28 government agencies
  - Experimental survey & User satisfaction survey
- **Findings**
  - Necessity of quality improvement
  - Some requirements from main users

## **Regulations for Quality Management**

- **Need to establish regulations in order to push forward with quality management**
  - Smoother cooperation between quality evaluators & the division of target statistics
- **Rules for executing quality management and for checking faults of statistical publications**
  - Being effective on only the statistics by KNSO

## **Organize an Independent QM Team**

- **Nature of assessment**
  - NSO staff being unwilling to assess statistics
  - Burden on relevant persons
- **Organization of a special QM team (July 2002)**
  - Under direct control of the commissioner of KNSO
  - Current Commissioner of KNSO(Dr. Jong-Nam OH)
    - Quality management as his main achievements
    - Show his strong will for quality management of KNSO
    - Define 'the concept of quality' as 'fitness for use'
    - Same definition as the international organizations & NSIs
- **Group of 10 persons**
  - 4 regular staff for planning & evaluation
  - 3 persons for checking errors of released data
  - 3 persons for monitoring field surveys

## **Statistical Quality Committee**

- **Functions**
  - Advise in quality evaluation process
  - Analyze results of the evaluation
  - Lead to quality improvement of statistics
- **16 members**
  - External experts(13 members) & internal directors(3 members)
  - External experts
    - Usually working in universities, research institutes & survey companies

## **Basic Strategies of QM**

- **Settlement of Quality Management System**
  - Efforts in establishing work system for individual steps, improving the procedures & making documentation of methodology in detail.
- **Development of quality assessment indicators**
  - Easy to measure quality of statistics
  - Show the future course of quality improvement by assessment results
- **Campaigns for publicize quality management**
  - Unfamiliar with the term "statistics quality"
  - Need to further publicity activities on quality management
    - Curriculum of the Statistical Training Center, a textbook, guidelines & brochure

- **Collaboration for quality management: users, producers and evaluators**
- **Effective feedback of assessment results**
  - Show future direction of quality improvement
  - Important to reflect the result of diagnosis in future plan
- **Laws, ordinances or regulations for QM**
  - To continuously develop the quality management system
  - Roles and responsibility for quality management
- **Training quality evaluators at KNSO**
  - train staff in methodology of quality work
  - Relevant conferences, workshop, mid-term training program and work experience at a certain international institutes

## **Development of Quality Assessment Framework**

## **Quality Dimension**

- **Develop quality assessment framework**
  - Environmental situations in process of statistical production
- **Quality dimensions**
  - accuracy, timeliness, relevance, accessibility, comparability & efficiency
- **Classify into 8 areas of statistical production**
  - 1) Survey planning, 2) Sampling, 3) Questionnaire design
  - 4) Management of interviewers, 5) Field survey
  - 6) Data compilation & analysis, 7) Data release, 8) Data distribution

## **Indicators by Quality Dimensions and Procedures**

Quality dimensions	Data Production Procedure									
	Total	Survey planing	Sampling	Questionnaire design	Management of Interviewer	Field survey	Data compilation & Analysis	Data release	Data distribution	
	48	9	7	5	3	5	4	6	9	
Accuracy	25	3	4	5	3	5	3	1	1	
Timeliness	4	1	-	-	-	-	-	3	-	
Relevance	3	3	-	-	-	-	-	-	-	
Accessibility	10	1	2	-	-	-	-	2	5	
Comparability	3	-	-	-	-	-	1	-	2	
Efficiency	3	1	1	-	-	-	-	-	1	

## **Survey Planing**

- Purpose of survey clearly defined
- Processes of data production are systematically documented
- Concepts, definitions & scheme based on international criteria
- Budget is properly allocated
- Requirements of users recognized and reflected to future plan
- Survey planners qualified with relevant knowledge of the statistics
- Planners fully recognize amount of field work
- Revision of survey follows a regular & transparent schedule

## **Sampling**

- Target population of survey defined precisely
- Adequate sampling method used to estimate population
- Sample of survey properly maintained
- Sample size is reasonable
- Register of sample house/establishment regularly updated
- Standard error of survey results open to the public
- Sampling method & process open to the public

## **Management of Interviewers**

- **Interviewers trained by systematic & sufficient programs**
- **Interviewers regularly trained**
- **Measuring interviewers' knowledge level of survey**

## **Field Survey**

- **Field survey systematically managed**
- **Actual situation of field survey method well recognized**
- **Problems in the field timely solved**
  - All interviewers share know-how or knowledge of solutions
- **Audit system of field survey**
  - Examine interviewers' fulfillment in field survey
- **Guidelines for non-response or long-absence**

## **Data Compilation and analysis**

- **Survey planner recognizes & analyzes non-response**
- **Results of survey adequately edited at every step of survey**
- **In case of estimating, estimation method open to the public**
- **Comparable with relevant or existing statistics**

## **Data Release**

- **Pre-checking system of publications prior to making public**
- **Provides users with sufficient explanation or helps**
- **Proper timing of publication**
- **All the users are able to use data at the same time**
- **Schedule of data release announced in advance**
- **Data release is punctual in keeping schedule announced**

## **Data Distribution**

- **Results in various media : Internet, publications, database, etc.**
- **Users access database conveniently and promptly**
- **Time lag from the data release to database is adequate**
- **Reasons for unreleased survey items, if any**
- **Internationally comparable.**
- **Time-serial data available**
  - **Substance of change in time-serial data open to public**
- **Users are able to use raw data**
- **Confidentiality of respondents fully protected**
- **Contact information for users' inquiries provided**

## **Quality Assessment Process**

## **Target Statistics for Assessment**

- **Every 3 years for 40 each regular survey**
  - Special plans for the long-term or temporary surveys, corresponding to the survey conduction
- **12 surveys are selected in 2002**

## **Quality Assessment Process**

- **5 areas**
  - 1) Data production procedures
  - 2) Monitoring Field survey
  - 3) Checking errors of released data
  - 4) Efforts for quality improvement
  - 5) Users satisfaction survey

## **Data Production Procedures**

- **Evaluate the production procedures**
  - Using assessment indicators
  - 3 steps
    - Self-assessment by division of target statistics
    - Review of result of self-assessment by QM team
    - Re-assessment by external experts of Quality Committee
  - Self-assessment questionnaire

## **Monitoring Field Survey**

- **Examine status of field survey**
  - By telephoning respondents
  - Just after interviewers finished data collection
- **Items**
  - Actual state of interviewing
  - Time-lag of interviews
  - Respondent's requirement
  - Accuracy of a certain item responded

## **Checking Errors of Released Data**

- **Accuracy of data**
- **Timeliness of data release (time-serial data)**
- **Structural consistency of publications**
- **User's convenience**

## **Efforts for Quality Improvement**

- **Annual plan established every early year**
  - **including quality improvement for each statistics**
- **Examine achievement of improvement planned**

## User satisfaction survey

- **Recognize main users of target statistics**
  - Selected from lists from various distributing points
  - Libraries, reading rooms, civil affairs offices, governmental book centers & web services
- **Survey via multi-methods**
  - Telephone, post mail, email-survey system, face-to-face
- **Questionnaire**
  - Accuracy of data, adequacy & convenience of data use

## Results of Assessment

- **1st draft of quality assessment from 5 areas**
  - Forwarded to divisions of target statistics
  - Good reasons for a certain item reflected in 2nd draft
- **3rd draft be subject to pass in Statistical Quality Committee**
- **Final report be presented at executives meeting**
  - Lead the divisions to improve quality of statistics

## User satisfaction survey

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  - Lead the divisions to improve quality of statistics

## **Feedback of Assessment Results**

- **Feedback of Quality Assessment Results**

- Lead divisions to improve the quality of data
  - Final report transferred to divisions
    - Improvement plan should be established
  - QM team watch progress of quality improvement
    - until improvement for one's shortcomings are completed

## **Conclusions**

- **Quality management plan of KNSO (2002-2004)**
  - Starting first year of the regular assessment system in 2002
  - At present, the quality assessment processes for 12 statistics in five assessment areas are simultaneously under way
- **Due to the nature of assessment**
  - Divisions of target statistics is unwilling to be examined
  - Lead the relevant staff to cooperate QM process
    - an educational book 'Understanding the statistical quality management'
    - a brochure 'Why the quality assessment?'
- **Still many difficulties in quality assessment framework, assessment processing & feedback of assessment results**

**Thank you & Danke**

**감사합니다!!**

# **Quality Management at NSO Korea**

Sulhee Kim

Quality Management Team, KNSO

## **Contents**

1. The history of quality management at KNSO
2. The strategy of quality management.
3. Quality assessment indicators framework
4. Quality assessment process
5. Feedback of assessment results
6. Conclusions

### **1. The history of quality management at KNSO**

The quality management at NSO was launched May 1999, without any leading study in Korea. A taskforce team was organized at Statistical Planing Division in order to collect relevant references and examine the previous examples of other national statistical offices. Base on the results of the studies, several systems have been introduced or developed by the staff of the team, as followed.

### **Quality assessment framework**

It is not easy job to measure the status of statistics quality. In order to recognize the quality of individual statistics, a standardized scale should be devised. Regarding an assessment scale, several previous instances for such a case was examined, such as Quality Guidelines by Statistics Canada, quality framework by IMF, Statistical Quality Checklist by ONS UK and so on. In late 2000, a draft of quality assessment framework was developed, which was experimentally applied to measure the quality of Consumer Price Index and Economic Activity Population Survey (Labour Force Survey). From the trial assessment, some problems to be solved were found. First, we need to make indicators easy to measure. Second, the objectivity and comparability of the assessment results.

### **A fact-finding survey of official statistics**

In the last year, the KNSO experienced some difficulties due to accidental mistake of making figures in a press release. So, we decide to take this opportunity to examine the quality status of 227 official statistics, which are produced by about 28 government agencies. The questionnaire for the survey included some questions from the assessment indicators above. We also carried out the user satisfaction survey for each statistics by a marketing research company. The items for this survey were based on the quality assessment framework of the KNSO. As the results of these surveys showed us the necessity for quality improvement and more requirements of the main users of statistics, we have examined the best way for them.

### **The Statistical Quality Seminar 2000**

The Statistical Quality Seminar was held in Jeju Island, Korea, which was cosponsored by the International Monetary Fund and KNSO. In the seminar, 45 experts from eight countries and seven international organizations participated and exchanged their expertise and experiences in statistical quality assessment and improvement as the theme of the seminar. It may be concerned not only with the various dimensions of the quality of statistical outputs, but also with the broader social and political context by the statistical organizations. In the section of national experiences in quality management, the trial version of quality framework was introduced by the former manager of Statistical Planning Division.

### **Regulations for quality management**

It may be necessary to establish regulations in order to push forward with quality management. The regulations can be used for the more smooth cooperation between quality the evaluators and the target staff of statistics.

Accordingly, both rules for executing quality management and for checking faults of statistical publications have been established and announced. These two regulations would be still effective in only the statistics by KNSO.

### **Organization of an independent team for quality management**

Since 1999, the year in which the quality activity was launched, it has not been easy to maintain independence of quality work. Due to the nature of assessment, the staff being responsible for the target statistics may respond unwillingly to the assessment programs. Moreover, quality evaluation job could be a burden on the relevant persons as extra work such as filling the self-assessment forms out, interviewing with the evaluators and so on.

Finally, in July this year, the team for quality management was separated from any divisions and became a special organization being under direct control of the Commissioner of KNSO. The current commissioner, Dr. Jong-Nam OH has become interested in quality management work as a chief goal of his achievement. The organization of an independent team has also shown his strong will for quality management of KNSO. He defines "the concept of quality" as "fitness for use", the same as that understood by the CEOs of the international statistical organizations such as OECD, as well as the most national statistical institutes.

Ten persons were arranged at the team, including four regular staff, three persons for checking faults of release data and three for monitoring the field surveys.

### **An advisory committee for quality management of statistics**

It was regulated to form an adversary committee for the quality management, in which provides the team with advice in planning quality evaluation, analyzing the results of the evaluation and leading to quality improvement of statistics. It consists of mostly outsiders, who usually work for universities, research institutes and survey companies.

## **2. The basic strategies of quality management team**

Since the quality management team became directly belong to the commissioner, the seven basic strategies have been set up as followed.

### **Settlement of quality evaluation system**

In order to set up the quality evaluation processes, the staffs have made efforts in establishing work system for individual steps, improving the procedures and making

documentation of the methodology in detail.

### **Development of quality assessment indicators**

The quality assessment indicators of KNSO has been developed, considering that the indicators should be easy to measure the quality of statistics and the results of assessment should show the future course of quality improvement.

### **Collaboration of three parts of quality management: users, producers and evaluators**

The results of quality assessment should be reliable. In order to raise reliability of assessment results, we would lead the producers as well as the users of statistics to participate in evaluation procedures of the quality management team.

### **Campaigns of publicity for quality management**

Most of member of KNSO should be unfamiliar with the term “statistics quality”. We need to further publicity activities on quality management, such as an education course in the curriculum of The Statistical Training Center, a textbook, guidelines and a brochure.

### **Effective feedback of assessment results**

The results of quality assessment should show the future direction of quality improvement of the statistics by KNSO. It is very important to reflect the result of diagnosis of quality status in the future plan.

### **Any laws, ordinances or regulations for data quality management**

In order to continuously develop the quality management system, the roles and responsibility for the quality management should be specified in the laws and ordinances.

### **Training the quality evaluators at KNSO**

The staff of the quality management team have not been trained in methodology of

quality work. The staff training may include participation in the relevant conferences, workshop, mid-term training program and work experience at a certain international institutes.

### **3. Development of a framework of quality assessment**

#### **Quality dimension**

KNOS have developed a framework of quality assessment, considering several environmental situations in the process of statistical production such as the methods and stricture of budget system, field survey, interviewing method and personal training system. The experiences of other NSOs and relevant statistical institutes have also been a great help to us in designing the framework.

Firstly, six quality dimensions are considered as suitable for our quality framework. They are 1) accuracy, 2) timeliness, 3) relevance, 4) accessibility, 5) comparability and 6) efficiency. As the term 'dimension' may not be familiar with daily work at KNSO, we have classified the assessment indicators into eight areas of the statistical production: survey planing, sampling, question design, management of interviewers, field survey, data compilation and data release. Table 1 shows the indicators by data production process in relation to quality dimensions.

**Table 1 Assessment indicators by quality dimension and procedures**

Quality dimension	Data production procedures								
	Total	Survey planing	sampling	Questionnaire design	Interviewers management	Field survey	Data compile and analyze	Data release	Data distribution
	48	9	7	5	3	5	4	6	9
Accuracy	25	3	4	5	3	5	3	1	1
Timeliness	4	1	-	-	-	-	-	3	-
Relevance	3	3	-	-	-	-	-	-	-
Accessibility	10	1	2	-	-	-	-	2	5
Comparability	3	-	-	-	-	-	1	-	2
Efficiency	3	1	1	-	-	-	-	-	1

#### **Assessment indicators**

Statistical production procedures are assessed based on the 48 quality assessment indicators. The assessment consists of three steps, including self-assessment by the data

production division, review of the results of self-assessment by the quality management and re-assessment by the external experts. The external experts are the members of the Statistical Quality Committee, which was organized in 2001, with 13 external experts and 3 internal managers for consulting and inquiring the quality management process at KNSO. The chairperson of the committee was also selected among the external experts.

Assessment indicators consist of 48 factors, which are able to influence on the quality of statistical results. They should be measurable, objective and practical. They are assessed using five levels of scale. The indicators by data production procedures are as the followings.

### 1) Survey planing

- The purpose of the survey is clearly defined.
- Processes of data production are systematically documented in order that the new staff is able to start to work without a temporary vacuum due to personnel transfers.
- The concepts, definitions and scheme in the survey are based on international criteria or regulations.
- The budget is properly allocated for producing the statistics.
- The requirements of main users of the statistics are recognized and reflected to the future survey planing.
- The survey planners are qualified with the survey relevant knowledge via training, workshop or educational system.
- The planners fully recognize the amount of field of the survey.
- The revision of the survey follows a regular and transparent schedule.

### 2) Sampling

- The target population of the survey is precisely defined.
- An adequate sampling method is used to estimate the population.
- A certain level of the sample of the survey is properly maintained.
- The sample size is reasonable for the purpose, budget and analyzing scope of the survey.
- The register of sample house/establishment is regularly updated.
- The standard error of the survey results is open to the public.

- The sampling method and process is open to the public.

### 3) Questionnaire design

- Wording in the questionnaire is easy to understand and the array of the questions is logical and natural.
- In case of self-interviewing survey, the respondents are provided with enough explanation for filling the questionnaire out.
- If there is change of item in a questionnaire, the pretest or pilot survey has been conducted.
- The questionnaire or the key-entry program is designed user-friendly.
- The interviewer's guidelines provide the interviewers with the ways of filling in the questionnaire, duties in the field, terminology explanation and so on.

### 4) Interviewers management

- The interviewers are trained by systematic and sufficient programs.
- The interviewers are trained regularly.
- There is a system for measuring the interviewers' knowledge level in the survey.

### 5) Field survey

- The field survey is systematically managed by a regular program.
- The actual condition of field survey method is well recognized.
- When any problems occur in the filed, they are timely solved. Moreover, the interviewers are able to share know-how or knowledge of solving the problems.
- There is an audit system of the field survey in which the interviewers' fulfillment in the survey is examined.
- There is guidelines for non-response or long-absence in the filed.

### 6) Data editing and analysis

- The survey planner recognizes and analyzes the non-response in the survey.
- The results of the survey are adequately edited from the field survey to data release.
- In case of estimating the target population, the estimation method is open to the

surveys. For the long-term or temporary surveys, separate plans would be established corresponding to the survey conduction. For this year, 12 surveys were selected as the target surveys.

#### Quality assessment process

The quality assessment process is divided into five areas: 1) the data production procedures, 2) the field survey, 3) publications, 4) efforts for quality improvement and 5) users satisfaction survey. The result of assessment is made by considering all the factors of each area.

##### 1) Assessment of data production procedures

The quality of data production procedures is evaluated using the framework of assessment indicators. We have three steps for procedure assessment: self-assessment by the division being responsible for the target statistics, review of the result of self-assessment, re-assessment by the external experts of the quality management committee. The self-assessment questionnaire is attached as an index.

##### 2) Monitoring the field survey

The status of the field survey is examined by telephoning the respondents, just after the interviewers have finished the data collection. When the monitor staff call the sampled respondents, the actual state of interviewing, the time-lag of interviews, the respondent's requirement and the accuracy of a certain item are inquired.

##### 3) Checking errors of the statistical publications

The publications of the target statistics are inspected based on the points such as accuracy of data, timeliness of data release (time serial data), structural consistancy of publications, user's convenience, etc.

##### 4) User satisfaction survey

The user satisfaction survey is also carried out for the main users of the target statistics. The main users are selected from the lists from various distributing points of statistics,

such as libraries, reading rooms, civil affairs offices, governmental book centers and web services. The survey is conducted via multi-methods such as telephones, post mail, email-survey system or face-to-face depending on the interviewee's situation. The questionnaire includes the inquiries about user's satisfaction with accuracy of data, adequacy and convenience of data use.

### 5) Assessment of efforts at quality improvement

The annual plan is established every early year, including quality improvement for each statistics. What extent of achievement of the improvement planned is evaluated.

The results of each assessment areas are put together to make a draft of quality assessment report. The draft would be forwarded to the divisions who are responsible for the target statistics. If the division's opinions have good reason for a certain items, they are reflected in the second draft. The second draft would be subject to the decision of the statistical quality committee. The final report would be presented at an executive members meeting.

## 5. Feedback of assessment results

There must be no use without feedback of the results of quality assessment. In order to lead the division of the target statistics to improve the quality of data, the final report would be transferred to the divisions in which an improvement plan should be established. Since then, the quality management team may examine the progress of quality improvement in relevant statistics until the improvement for one's shortcomings is completed.

## Conclusions

According to the quality management plan of KNSO (2002-2004), we have started the first year of the regular assessment system. At present, the quality assessment processes for 12 statistics in five assessment areas have been simultaneously under way.

Due to the nature of assessment, the staff responsible for the target statistics is unwilling to be examined. To lead the relevant staff to cooperate the quality assessment process, an educational book titled 'Understanding the statistical quality management' and a

brochure titled 'Why the quality assessment?' were published.

Although we have prepared for about four years to introduce the new system for the quality management at KNSO, we have still several difficulties in setting up the quality assessment framework, assessment processing and feedback of the assessment results.

## **Questions at Korea-Germany Cooperation Meeting**

- 1. Methodology of Measuring and Improving Data Quality by the GSS(M) Task Force on Non-sampling Error**
- 2. Current statistical quality checklist of ONS**
  - Who is responsible for making checklist for statistical quality assessment?
  - Whether checklist is made for individual statistics or for whole the statistics produced by Destatis
- 3. Organization for quality assessment (permanent or provisional)**
  - I am asking about organization. In 1998, KNSO decided to start quality work in order to check the quality in field survey, data processing, analyzing and distributing the results and improve/develop the statistics quality. We introduced quality assessment system April 1999. A team for quality assessment was established in Planning Division, Statistical Planning Bureau. We defined the range of duty of the team as collecting information of assessment indicators and methods, selecting target statistics among statistics produced by KNSO, deciding assessment indicators, carrying out user satisfaction surveys and assessing data quality. Nowadays we have 10 persons including four regular workers, three inspectors on published reports and three monitors on field surveys. How has SCB managed this matter? Would you explain us about the team being responsible for data quality management?
  - What the level of knowledge and experience in quality management of the team?
  - I asking whether the team has been operated as permanent or temporary. If the team is permanent organization, what organization this team belongs to?
- 4. Manpower supply for the team of data quality management**
  - As I understand, each member of the quality team should have been trained or educated with knowledge of this area. How does SCB supply manpower for the team of data quality management.
  - Is there any special employment for the quality work at SCB?
  - I wonder whether any training course for quality assessment for statistical matters as curriculum or special program at university or institutes?
  - As I understand, in Korea, there are a few experts who has been educated and trained in the area of statistics quality. What is the situation in Sweden?

**5. User satisfaction surveys**

**6. Monitoring the field survey or the interviewers**

- In Korea, we plan to spot check the field survey conducted by the interviewers of face-to-face interviewing. Which surveys have you experienced to monitor the situation of the field survey?
- As we understand, you have system of auditing of local price collection and monthly processing. Would you explain us the detailed methods of auditing.

**7. Quality assessment indicators and weights for each indicator.**

- According to Director Lee's paper, we have made a pilot assessment indicators as attached file.
- Please show us some quality assessment indicators and weight for each indicator, I mean the most current one.

**10. Any laws, ordinances or regulations for data quality management**

- Since KNSO started to work for quality management, the team of quality management was legislated in the law of organization of KNSO. A guiding principle for quality assessment was established in 2001. A regulation for auditing statistical publications was also legislated in 2001.
- Would you explain about any laws, ordinances or regulations with relation to data quality assessment?

**11. Feedback system (How to improve data quality using the results of quality assessment)**

- After we carried our assessment, we should make assessment reports. Before the reports are referred to the Committee on Data Quality Assessment, those are examined by the team responsible for the target statistics. The director of Planning Division should give the Commissioner a summary report of the results and give warning and asking for making the improvement plans. Afterwards the quality team should monitor the progress of the improvement term by term until they finish the improvement activities.
- If you have any feedback system for quality improvement, please introduce them for us.

# Quality Management and Process Analysis at the Federal Statistical Office Germany

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25.10.2002

Folie 1

## CONTENTS

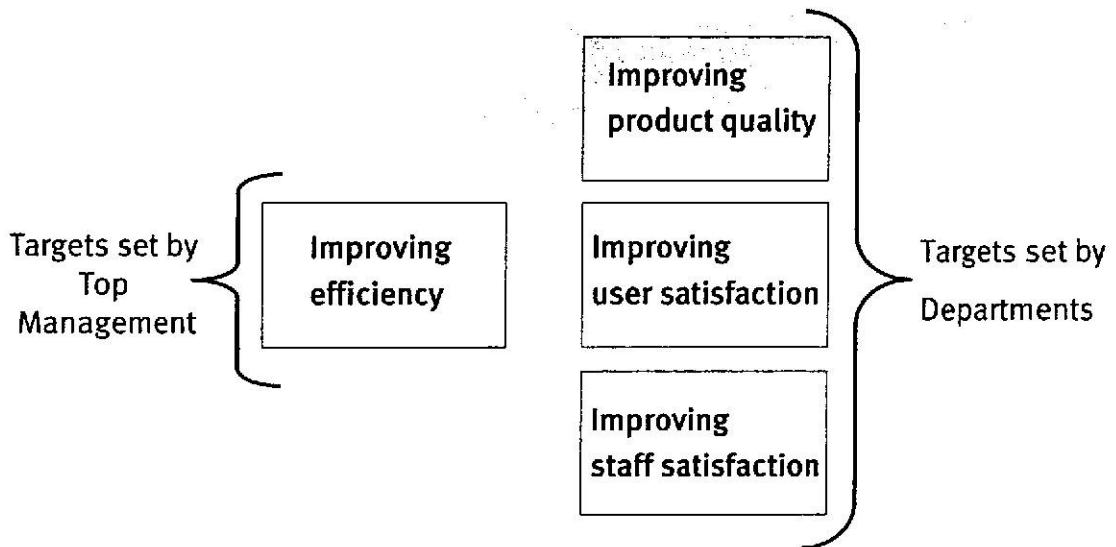
- 1. Overview - Tasks and environment of the Federal Statistical Office**
- 2. Concept of the Quality Offensive**
- 3. Process analysis and the way involving staff**

## TASKS OF THE FEDERAL STATISTICAL OFFICE

- We are the most important information service provider in Germany
- We inform public administrations, political parties, citizens, companies and different lobby groups
- We produce statistics which are an essential basis for decisions in a democratic society
- We offer taylor-made statistics on demand for individual customers
- We design and produce our products in co-operation with the statistical offices of the German Länder
- We have a staff of about 2,800 working in three local units
- We have a budget of approxiametly 129 Mill. €

## 1. OVERVIEW – TASKS AND ENVIRONMENT OF THE FEDERAL STATISTICAL OFFICE

## WHAT DO WE WANT TO ACHIEVE?



## CURRENT PROBLEMS OF OFFICIAL STATISTICS

- Decreasing budget
- Increasing demand for statistical data
- Increasing demand for more complex analyses (reports covering several areas of statistics, government reports, new indicators etc.)
- Increasing quality requirements for statistics (timeliness, accuracy, comparability etc.)
- Increasing resistance against statistics
- Changes in the way of dissemination (e-products replacing print products)
- Acceleration of structural changes in the production processes induced by IT

## 2. CONCEPT OF THE QUALITY OFFENSIVE

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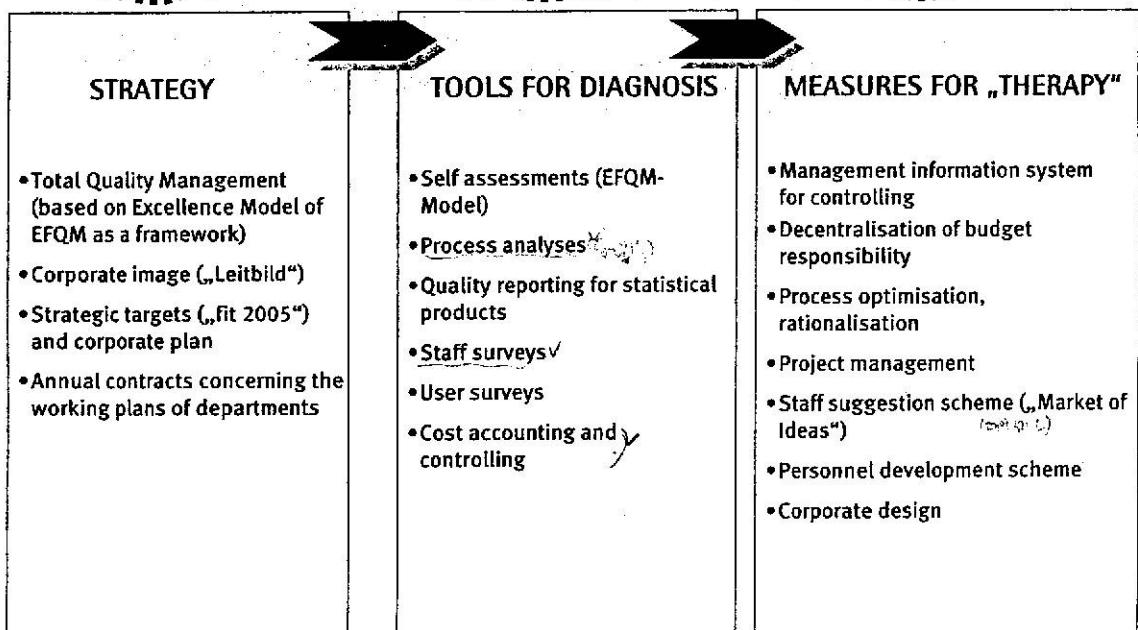
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### THE „RULES OF THE GAME“

**Quality improvement plan required for each department  
minimum amount of costs reduction of 30% in a 5 year period:**

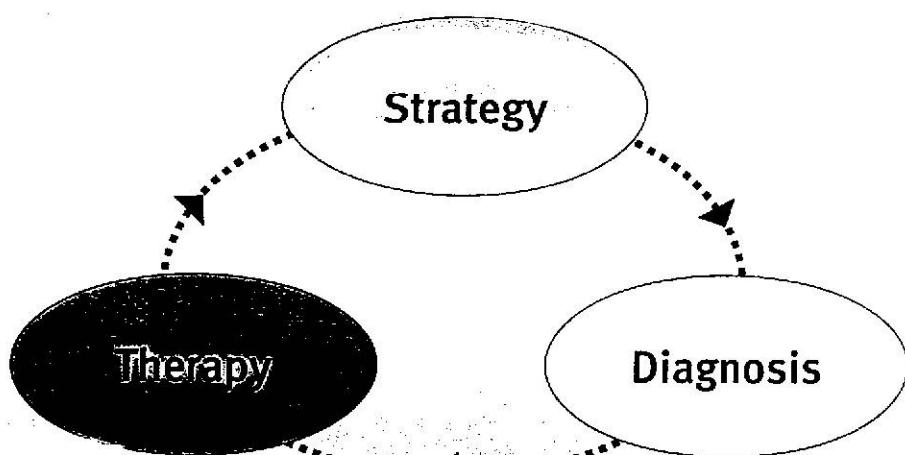
- 7,5% for savings
- 7,5% for new tasks („contest of ideas“ between the departments)
- 15% loss during realisation



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## THREE STEPS OF THE QUALITY OFFENSIVE



### 3. PROCESS ANALYSIS AND THE WAY INVOLVING STAFF

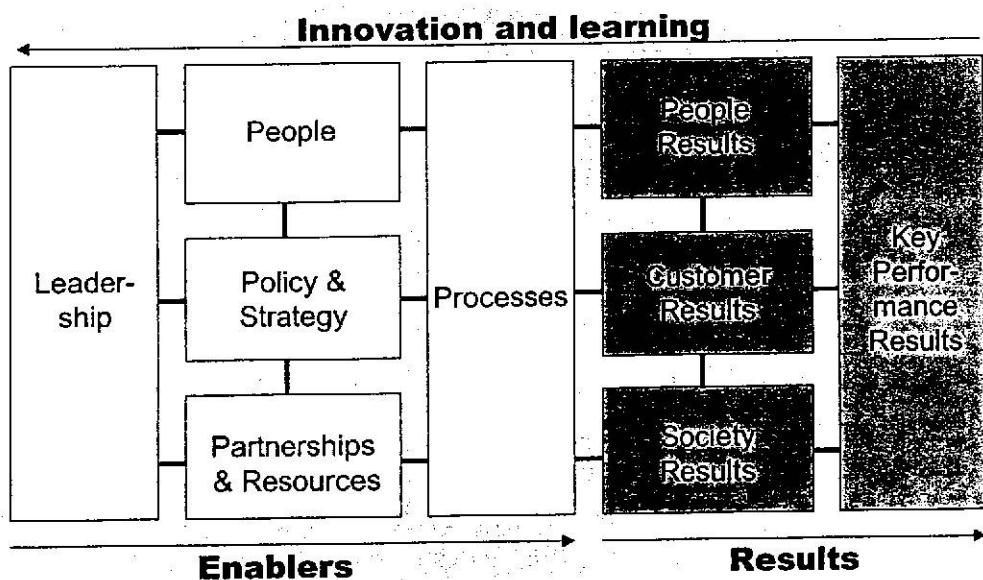
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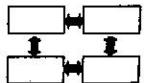
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### THE EFQM-MODEL





## IMPLEMENTATION APPROACH

### Traditional Approach

- Productivity depending on detailed order and control
- Changes only by pressure and control
- External commission of inquiry
- „Objective“ measurement of manpower required
- Mutual distrust, car castle mentality/unit identity

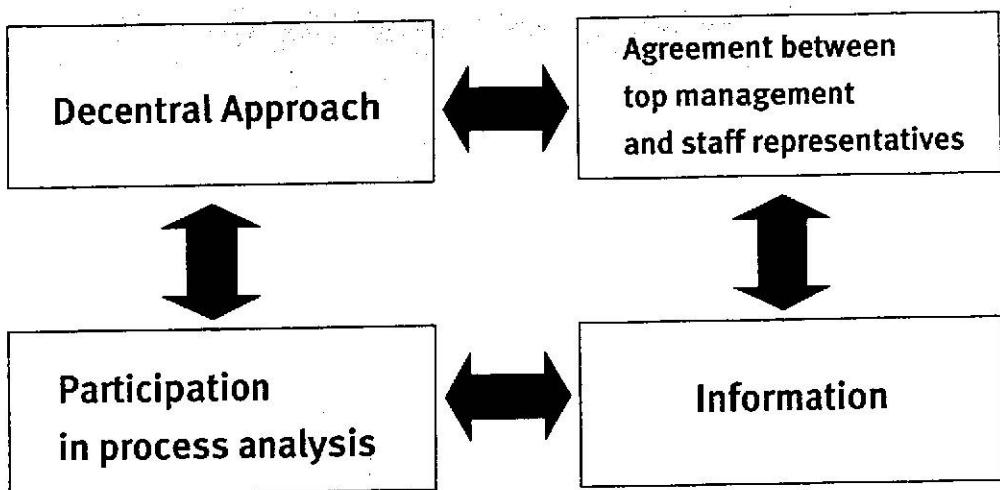
### Decentral Approach

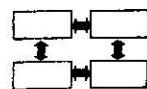
- Productivity depending on creative and innovative personnel, ready to take over responsibility
- Changes by motivation and own priority-setting
- Development of new ideas by the employees responsible for production processes
- Process analysis leaving a considerable freedom for creativity
- Mutual support and trust, co-operation and corporate identity

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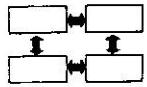
## HOW DO WE INVOLVE STAFF IN THE REFORM PROCESS?





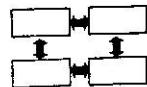
## INFORMATION

- Basic information on TQM in more than 50 workshops
- Kick-off-Workshops addressing the following questions:  
Why process analysis?  
How does it work?  
Where is my individual role in the process analysis?
- Informationbooklets and internal newsletters about:  
Quality Offensive (about the current status)  
Strategic goals, Corporate Image
- Intranet

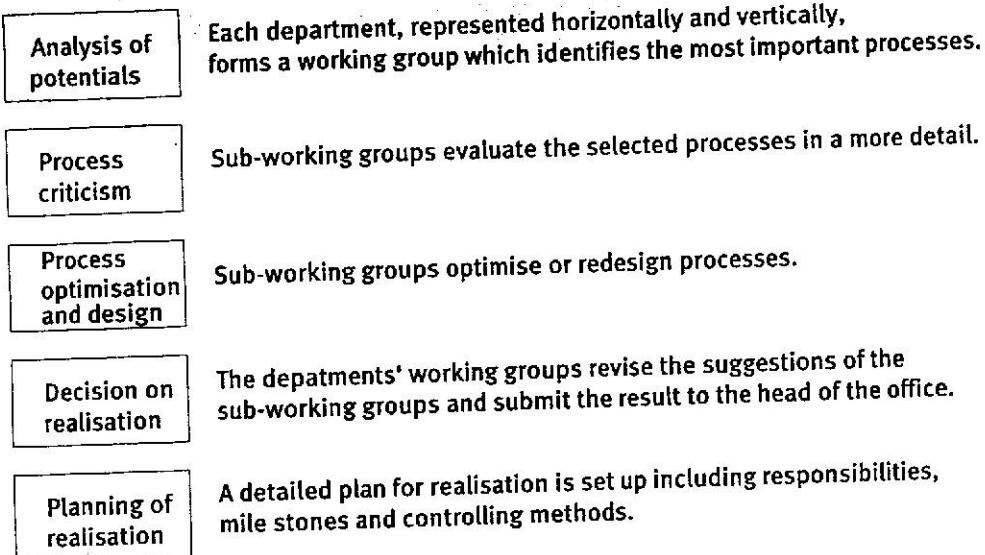


## AGREEMENT BETWEEN TOP MANAGEMENT AND STAFF REPRESENTATIVES REGARDING CHANGE

- Early involvement and information of persons affected (new qualification, personnel development)
- Flexibility and willingness for professional training are expected
- Move from Wiesbaden Office to Bonn Branch or vice versa as an exceptional case
- On-going employment of part-timers and teleworkers
- No dismissals, no degrading in lower salary groups
- Restructuring the personnel on a long term time scale

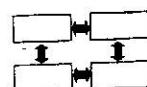


## PROCESS ANALYSIS

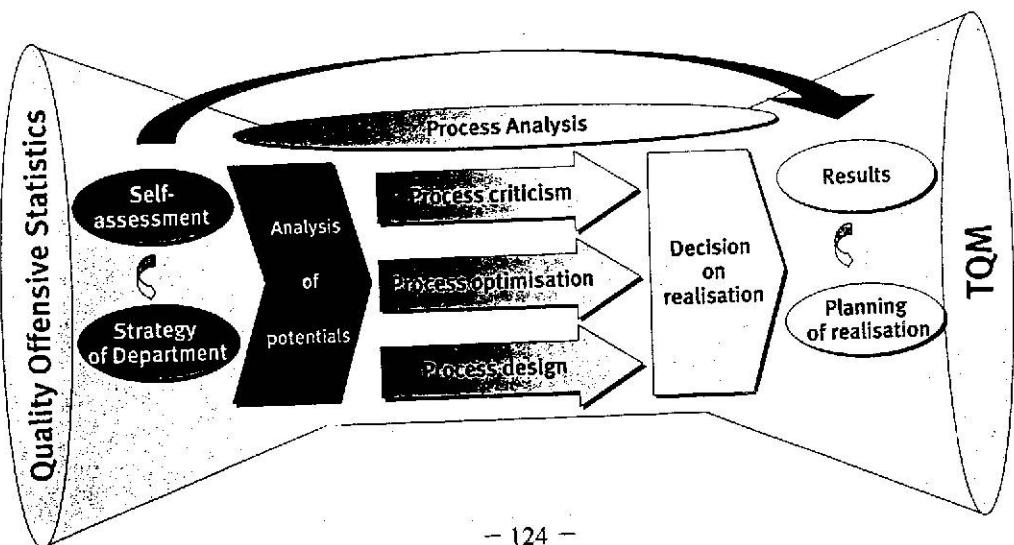


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## PROCESS ANALYSIS

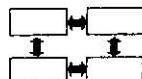


## RESULTS OF THE PROCESS ANALYSIS

- Subsequent implementation of the process analysis scheme in each of our 10 departments (from October 2000 to March 2002). A total of 850 (30%) out of our 2,800 employees have taken an active role in the process analysis.
- Every department delivered the required results which have meanwhile been presented to and accepted by a steering committee. Implementation of the improvement ideas did already make considerable progress.
- A total of 1,081 improvement ideas have been generated during the 18 months of the project.
- Ideas contain innumerable potentials for quality improvements and could result in savings of about € 34 million (representing 26,4 % of our budget).

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## PARTICIPATION IN PROCESS ANALYSIS

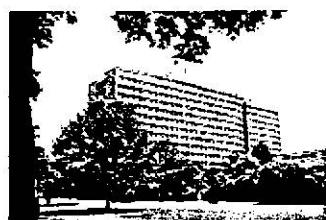
Staff involvement in working groups and sub-working groups:

- Analysis of potentials:  
Selecting the main products and processes in each organisational unit
- Process criticism:  
Monitoring and evaluation of processes in each organisational unit
- Process optimisation and design:  
Optimisation and redesign of processes and improvement suggestions to raise efficiency in each organisational unit

**...thank you for your attention.**

Contact: [www.destatis.de](http://www.destatis.de)

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[sebastian.czajka@destatis.de](mailto:sebastian.czajka@destatis.de)



## **Quality Declaration of the European Statistical System**

### **The mission of the European Statistical System**

*"We provide the European Union and the world with high quality information on the economy and society at the European, national and regional levels and make the information available to everyone for decision-making purposes, research and debate."*

### **The vision of the European Statistical System**

*"The ESS will be a world leader in statistical information services and the most important information provider for the European Union and its member states. Based on scientific principles and methods, the ESS will offer and continuously improve a programme of harmonised European statistics that constitutes an essential basis for democratic processes and progress in society."*

**To realize this mission and vision, the members of the European Statistical System strive for joint cooperation according to the following principles:**

- **User focus**

We provide our users with products and services that meet their needs. The articulated and non-articulated needs, demands and expectations of external and internal users will guide the ESS, its members, their employees and operations.

- **Continuous improvement**

The needs and demands of users will change as will the environment we operate in. Globalisation and advances in methods and technology will avail new possibilities. It is imperative that we actively strive to improve our work methods to take advantage of the new possibilities and to better meet the demands of our users.

- **Product quality commitment**

We produce high quality statistical information according to scientific methods in accordance with objectivity and confidentiality. We provide information on the main quality characteristics of each product so that users are able to assess product quality.

- **Accessibility of information**

We provide statistical results in a user-friendly and accessible form. Utilizing the possibilities of new media ensures easy access to the information. As far as possible, we will enhance user awareness of the strengths and limitations of the produced statistics. Consulting on how to use data is an integral part of dissemination.

- **Partnership within and beyond the European Statistical System**

The cooperation between current and future members of the ESS as well as with other organisations will be encouraged. Only by working together, can we learn from others and gradually develop our system. The broad knowledge of staff and our users, suppliers, partners and other parties must be combined for us to excel in our purpose.

- **Respect for the needs of data suppliers**

The suppliers of data for statistics – the respondents – are an especially important group with which a mutually rewarding partnership must be established. The producers of statistics

should strive to always minimise the respondent burden, both the objective and the perceived burden.

- **Commitment of leadership**

The leaders of the organisations in the ESS exercise a personal, active, and visible leadership to create and sustain a culture of quality. By providing a clear overall direction, prioritising improvement activities and stimulating empowerment and innovation, leaders enable the staff to perform a successful job and to continuously strive for improvement.

- **Systematic quality management**

We systematically and regularly identify strengths and weaknesses in all relevant areas to continuously identify and implement improvements where needed. A long-term strategic orientation is vital for the development of the ESS. The long-term effects in all situations must be considered with the more obvious short-term effects.

- **Effective and efficient processes**

ESS activities should be seen as processes that create value for the users. We work efficiently to produce output with as little resources as possible and to prevent errors in the processes and products. The processes and their quality are continuously reviewed and improved.

- **Staff satisfaction and staff development**

To attract and keep competent staff, it is vital to satisfy staff needs. The ESS members should treat their employees as the key resources they are.

Ulrike Cieplik

Statistisches Bundesamt

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Pressemitteilung vom 31. Juli 2002 – 000/02 – Seite 5

Informationen zum durchschnittlichen Revisionsbedarf vorläufiger Ergebnisse im Einzelhandel

**Durchschnittliche Revisionen der vorläufigen  
nominalen Umsatzmesszahlen  
in Prozentpunkten**

WZ-Position	Durchschnittliche Revisionen ohne Berücksichtigung des Vorzeichens		Durchschnittliche Revisionen mit Berücksichtigung des Vorzeichens	
	Pressebericht zu endgültigem Ergebnis	Pressebericht zu Messzahlenbericht	Pressebericht zu endgültigem Ergebnis	Pressebericht zu Messzahlenbericht
52	1,0	0,4	+ 0,7	+ 0,3

Ein Nachweis des Revisionsbedarfs der Umsatzmesszahlen für einzelne WZ-Positionen ist nicht möglich, da im Vorbericht zu diesen Unterteilungen nur Veränderungsraten nachgewiesen werden (s. nachfolgende Tabelle).

**Durchschnittliche Revisionen der vorläufigen  
nominalen Umsatzveränderungsraten  
(Berichtsmonat zum Vorjahresmonat)  
in Prozentpunkten**

WZ-Position	Durchschnittliche Revisionen ohne Berücksichtigung des Vorzeichens		Durchschnittliche Revisionen mit Berücksichtigung des Vorzeichens	
	Pressebericht zu endgültigem Ergebnis	Pressebericht zu Messzahlenbericht	Pressebericht zu endgültigem Ergebnis	Pressebericht zu Messzahlenbericht
52	0,9	0,4	+ 0,7	+ 0,3
52.1	1,5	0,3	+ 0,9	+ 0,2
52.2	5,2	5,3	- 5,1	- 5,2
52.3	1,3	0,4	+ 1,2	+ 0,4
52.4	0,8	0,8	+ 0,4	+ 0,1
52.6	1,5	0,7	- 0,7	+ 0,2

# **Population Situation in Korea**

**2002. 10.**

**Korea National Statistical Office**

## I . Population Trend

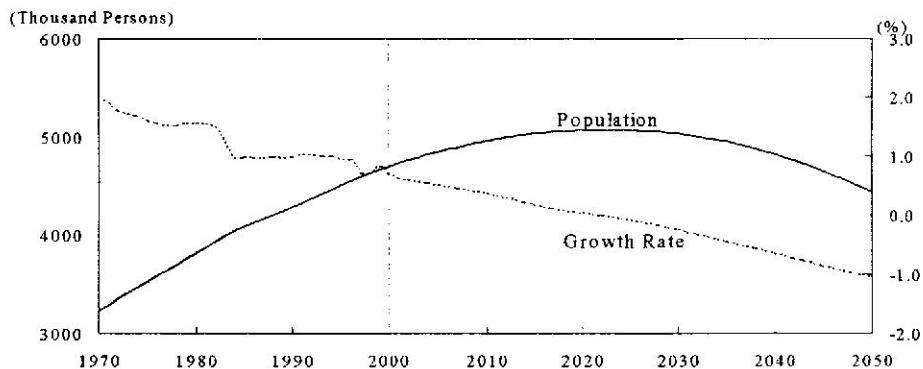
### 1. The change in Population Size

- The population was 47 million in 2000, a rise up to 22 million from the 1960 population.
- The population is projected to be 44 million in 2050, after peaking at 51 million in 2023.

**Population Trend**

	(Unit : Thousand persons, %)				
	1960	1980	2000	2023	2050
Total	25 012	38 124	47 008	50 683	44 337
increased population	-	13 112	8 884	3 675	▲6 346
growth rate	3.00	1.57	0.84	0.00	▲1.01

**Population and population growth rate**



## 2. The change in Population Structure

- The younger population is likely to decline but the elder population is likely to rapidly grow.
  - Due to a gradual decrease of births, the younger population under 15 years old decline.
  - The elderly population aged 65 or over rises rapidly owing to an increase of average life expectancy.
  - The elderly population aged 65 years or over accounted for 7.2 percent of total population in 2000.
  - The proportion of the elderly population is projected to rise from 14.4 percent in 2019 to 20 percent in 2026.

**Percentage of Population by age**

age \ year	1960	1980	2000	2019	2026	2050
Total	100.0	100.0	100.0	100.0	100.0	100.0
0~14	42.3	34.0	21.1	14.1	12.8	11.0
15~64	54.8	62.2	71.7	71.4	67.2	58.3
65+	2.9	3.8	7.2	14.4	20.0	30.7

## **II. Population Issues**

### **1. Rapid population aging**

- Due to a gradual decrease of fertility, the younger population(aged 0-14), which stood at 9,911(21.1%) in 2000, is expected to rapidly decrease 7,034(13.9%) in 2020, and 6,217(12.4%) in 2030.
- Koreas already entered an aging society, with the population aged 65 or over exceeding 7 percent of the total in 2000 and is expected to enter an aged society, with the population aged 65 or over exceeding 14 percent of the total in 2019.
  - It'll take 19 years that the percent of the elderly population increases from 7 percent to 14 percent and take 7 years that the percent increases from 14 percent to 20 percent, which is quite rapid compared to the advanced nations.
- As the elderly population increases, the old-age dependency ratio is expected to increase from 10 in 2000 to 36 in 2030.

## Change in population structure

(Unit : Thousand persons, %)

age \ year	2000	2005	2010	2020	2025	2030
Total	47 008	48 461	49 594	50 650	50 649	50 296
○ 0 - 14	9 911	9 518	8 552	7 034	6 568	6 217
(%)	(21.1)	(19.6)	(17.2)	(13.9)	(13.0)	(12.4)
○ 15 - 64	33 702	34 577	35 741	35 948	34 391	32 475
(%)	(71.7)	(71.4)	(72.1)	(71.0)	(67.9)	(64.6)
○ 65+	3 395	4 366	5 302	7 667	9 689	11 604
(%)	(7.2)	(9.0)	(10.7)	(15.1)	(19.1)	(23.1)
○ dependency ratio	39.5	40.2	38.8	40.9	47.3	54.9
- aged-child dependency ratio	29.4	27.5	23.8	19.6	19.1	19.1
- old-age dependency ratio	10.1	12.6	14.8	21.3	28.2	35.7

Source : KNSO, 「Population projections」, 2001

## The year when each country becomes an aging society

Nation	the reaching year			the number of year	
	7%	14%	20%	7%→14%	14%→20%
Korea	2000	2019	2026	19	7
Japan	1970	1994	2006	24	12
Germany	1932	1972	2010	40	38
U.K	1929	1976	2020	47	44
U.S	1942	2014	2030	72	16
Sweden	1887	1972	2011	85	39

<sup>1</sup> The percent of the elderly population in the total population

Source : National Institute of Population and Social Security Research,

「Latest Demographic Statistics」, 2001/2000, Japan

## 2. The heavily concentrated Population in Seoul metropolitan area(SMA)

- The 46.7 percent of the total population live in Seoul metropolitan area in 2002, while only 28 percent of the total population lived in the area in 1970.
- Since 1990 the in-migration to the area had decreased rapidly, but after 1998 the in-migration has increased.
  - Because of IMF crisis, the net-migration in the area was 9 thousand in 1998, but the net-migration increased from 95 thousand in 1999 to 136 thousand in 2001.

**Population distribution of SMA<sup>1</sup>**

(Unit: Thousand persons, %)

	1970	1980	1990	1995	2000	2001	2002
Total	32 241	38 124	42 869	45 093	47 008	47 343	47 640
SMA	9 126	13 544	18 342	20 414	21 747	22 013	22 250
(%)	(28.3)	(35.5)	(42.8)	(45.3)	(46.3)	(46.5)	(46.7)

<sup>1</sup>SMA consists of Seoul, Inchon and Kyunggi-province

Source : KNSO, 「Population projections by province」, 2002

### In-migration and Out-migration between SMA and all other regions

(Unit : Thousand persons)

	1990	1993	1995	1997	1998	1999	2000	2001
In-migrants	748	586	516	519	480	585	586	586
Out-migrant	472	435	447	456	471	490	436	450
Net-migration	276	152	68	62	9	95	150	136

Source : KNSO, 「Annual report on the internal migration statistics」, 2001

### 3. High sex ratio of death rate in age groups of 40s and 50s

- The sex ratio of death, the male death rate per female death rate was 1.3 in 2001.
- The high ratio of aged 40s and 50s was about 3, in 2001, showing male was nearly 3 times more susceptible to death than female.
  - Male's leading causes of death in his 40s was diseases of the liver and traffic accidents in 2001.
  - Male's leading causes of death in his 50s was cerebrovascular disease and diseases of the liver and traffic accidents in 2001.

**Sex ratio of death rate**

(Unit : male death rate per female death rate)

year age \	1990	1995	1998	1999	2000	2001
Total	1.33	1.28	1.26	1.24	1.24	1.24
0-9	1.21	1.14	1.13	1.16	1.13	1.14
10-19	1.91	1.98	1.85	1.88	1.85	1.70
20-29	2.11	2.23	2.27	2.24	2.25	2.13
30-39	2.60	2.71	2.44	2.37	2.32	2.39
40-49	2.64	2.89	2.99	3.03	2.95	2.95
50-59	2.53	2.75	2.86	2.88	2.88	2.86
60+	1.48	1.43	1.40	1.39	1.38	1.38

Source : KNSO, 「Annual report on vital statistics」, 2001

#### 4. Disintegration of Families

- One-person household increased to 15.5 percent of all households, 14.2 percent in the case of the one-generation households owing to industrialization and urbanization in 2000.
  - The proportion of the elderly person living alone aged 65 or over in the same age population rapidly increased from 6.6 percent in 1985 to 24.4 percent in 2000.
- The CDR rapidly increased from 1.1 per thousand population in 1990 to 2.8 in 2001.
  - The divorces with the children under 20 years old accounted for 70.3 percent of all divorces in 2001.

**Percent of household**

(Unit : % )

	Total	one-person household		one-generation households	two-generation households	three-generation households	four-or-more generation households
		elderly household <sup>1</sup>	household				
1970	100.0	3.7	-	6.5	67.4	22.4	-
1980	100.0	4.8	-	8.3	68.5	16.9	1.5
1985	100.0	6.9	6.6	9.6	67.0	14.8	1.7
1990	100.0	9.0	8.9	10.7	66.3	12.5	1.5
1995	100.0	12.7	13.2	12.7	63.3	10.0	1.4
2000	100.0	15.5	24.4	14.2	60.8	8.4	1.1

<sup>1</sup>The proportion of the elderly person living alone aged 65 or over in the same age population

Source : KNSO, 「Population and Housing Census Report」

**Divorces and Crude Divorce Rate(CDR)**

(Unit : Thousand cases, %, %)

	1990	1993	1995	1996	1997	1998	2000	2001
Divorces	45.7	59.3	68.3	79.9	91.2	116.7	120.0	135.0
CDR	1.1	1.3	1.5	1.7	2.0	2.5	2.5	2.8
percentage of the divorces with the children	-	65.6	71.4	71.9	71.6	71.8	70.4	70.3

<sup>1</sup>The children is under 20 years old.

Source : KNSO, 「Annual report on vital statistics」, 2001

### **III. Main discussion issues**

#### **1. Population projections**

- When you made the base population, did you adjust it?  
If you did, how did you do that?
- What is the most important standard dividing medium-fertility, high-fertility, and low-fertility assumption ?
- In the case of mortality, how did you establish the relation between average life expectancy and death probability by age?
- What was the main point in the case of the assumption of international migration?
- What kind of program do you use to project the population?

#### **2. Population projections by province**

- How did you reflect the different level of fertility and mortality by province ?
- How did you adjust total population and the sum of population by province?
- How did you assume inter-migration and adjust the sum of inter-migration?
- What kind of program do you use to project the population by province?

#### **3. Life table**

- How did you adjust death probability by age, especially the elderly age?
- To make the death probability in life table by province, how did you reflect inter-migration?

#### **4. TFR**

- How did you make TFR?
- What is the relationship between TFR and cohort TFR in view of rapid drop of TFR?

**<Appendix>**

**1. Population**

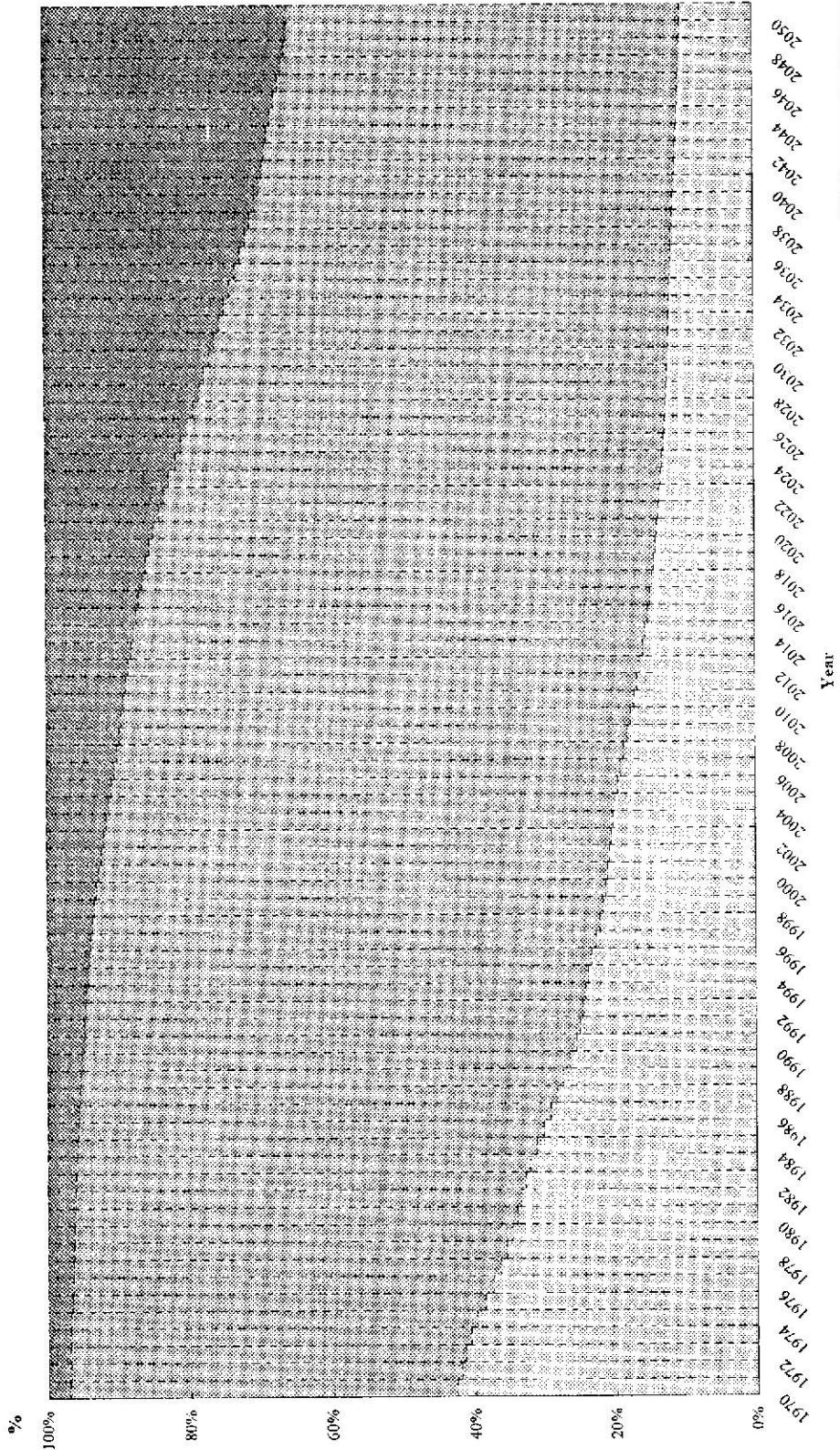
**Table 1-1. Population Trends, Sex ratio and Growth rate (1960-2050)**

Year	Both sexes	Male	Female	Sex ratio	Growth rate(%)
1960	25,012,374	12,550,691	12,461,683	100.7	3.01
1970	32,240,827	16,308,607	15,932,220	102.4	1.99
1980	38,123,775	19,235,736	18,888,039	101.8	1.57
1990	42,869,283	21,568,181	21,301,102	101.3	0.99
1995	45,092,991	22,705,329	22,387,662	101.4	0.96
1996	45,524,681	22,924,512	22,600,169	101.4	0.94
1997	45,953,580	23,148,092	22,805,488	101.5	0.72
1998	46,286,503	23,295,727	22,990,776	101.3	0.71
1999	46,616,677	23,457,837	23,158,840	101.3	0.84
2000	47,008,111	23,666,769	23,341,342	101.4	0.71
2001	47,342,828	23,835,309	23,507,519	101.4	0.63
2002	47,639,618	23,983,838	23,655,780	101.4	0.60
2003	47,925,318	24,126,185	23,799,133	101.4	0.57
2004	48,199,227	24,260,585	23,938,642	101.3	0.54
2005	48,460,590	24,387,814	24,072,776	101.3	0.52
2010	49,594,482	24,932,771	24,661,711	101.1	0.38
2015	50,352,318	25,282,576	25,069,742	100.8	0.18
2020	50,650,260	25,377,186	25,273,074	100.4	0.04
2025	50,648,525	25,299,049	25,349,476	99.8	-0.08
2030	50,296,133	25,046,468	25,249,665	99.2	-0.24
2035	49,483,999	24,565,370	24,918,629	98.6	-0.44
2040	48,204,474	23,836,935	24,367,539	97.8	-0.64
2045	46,470,670	22,881,983	23,588,687	97.0	-0.86
2050	44,336,997	21,751,590	22,585,407	96.3	-1.04

**Table 1-2. Population by Sex and Major Age Group (1960-2050)**

year	Both sexes (person)				Percent distribution		
	Total	0-14 years	15-64 years	65 years and over	0-14 years	15-64 years	65 years and over
1960	25,012,374	10,587,583	13,698,341	726,450	42.3	54.8	2.9
1970	32,240,827	13,709,367	17,540,152	991,308	42.5	54.4	3.1
1980	38,123,775	12,950,775	23,716,967	1,456,033	34.0	62.2	3.8
1990	42,869,283	10,973,592	29,700,607	2,195,084	25.6	69.3	5.1
1995	45,092,991	10,536,828	31,899,511	2,656,652	23.4	70.7	5.9
1996	45,524,681	10,403,277	32,326,522	2,794,882	22.9	71.0	6.1
1997	45,953,580	10,233,102	32,791,167	2,929,311	22.3	71.4	6.4
1998	46,286,503	10,091,517	33,125,933	3,069,053	21.8	71.6	6.6
1999	46,616,677	9,972,894	33,420,207	3,223,576	21.4	71.7	6.9
2000	47,008,111	9,911,229	33,701,986	3,394,896	21.1	71.7	7.2
2001	47,342,828	9,860,001	33,903,614	3,579,213	20.8	71.6	7.6
2002	47,639,618	9,792,573	34,074,591	3,772,454	20.6	71.5	7.9
2003	47,925,318	9,718,733	34,237,549	3,969,036	20.3	71.4	8.3
2004	48,199,227	9,632,613	34,395,598	4,171,016	20.0	71.4	8.7
2005	48,460,590	9,517,521	34,577,106	4,365,963	19.6	71.4	9.0
2010	49,594,482	8,551,714	35,740,673	5,302,095	17.2	72.1	10.7
2015	50,352,318	7,682,494	36,324,424	6,345,400	15.3	72.1	12.6
2020	50,650,260	7,034,423	35,948,429	7,667,408	13.9	71.0	15.1
2025	50,648,525	6,568,078	34,391,125	9,689,322	13.0	67.9	19.1
2030	50,296,133	6,217,381	32,475,033	11,603,719	12.4	64.6	23.1
2035	49,483,999	5,930,727	30,362,113	13,191,159	12.0	61.4	26.7
2040	48,204,474	5,522,324	28,148,960	14,533,190	11.5	58.4	30.1
2045	46,470,670	5,059,173	26,342,170	15,069,327	10.9	56.7	32.4
2050	44,336,997	4,649,549	24,416,858	15,270,590	10.5	55.1	34.4

**Graph 1-2. Population by Sex and Major Age Group (1960-2050)**

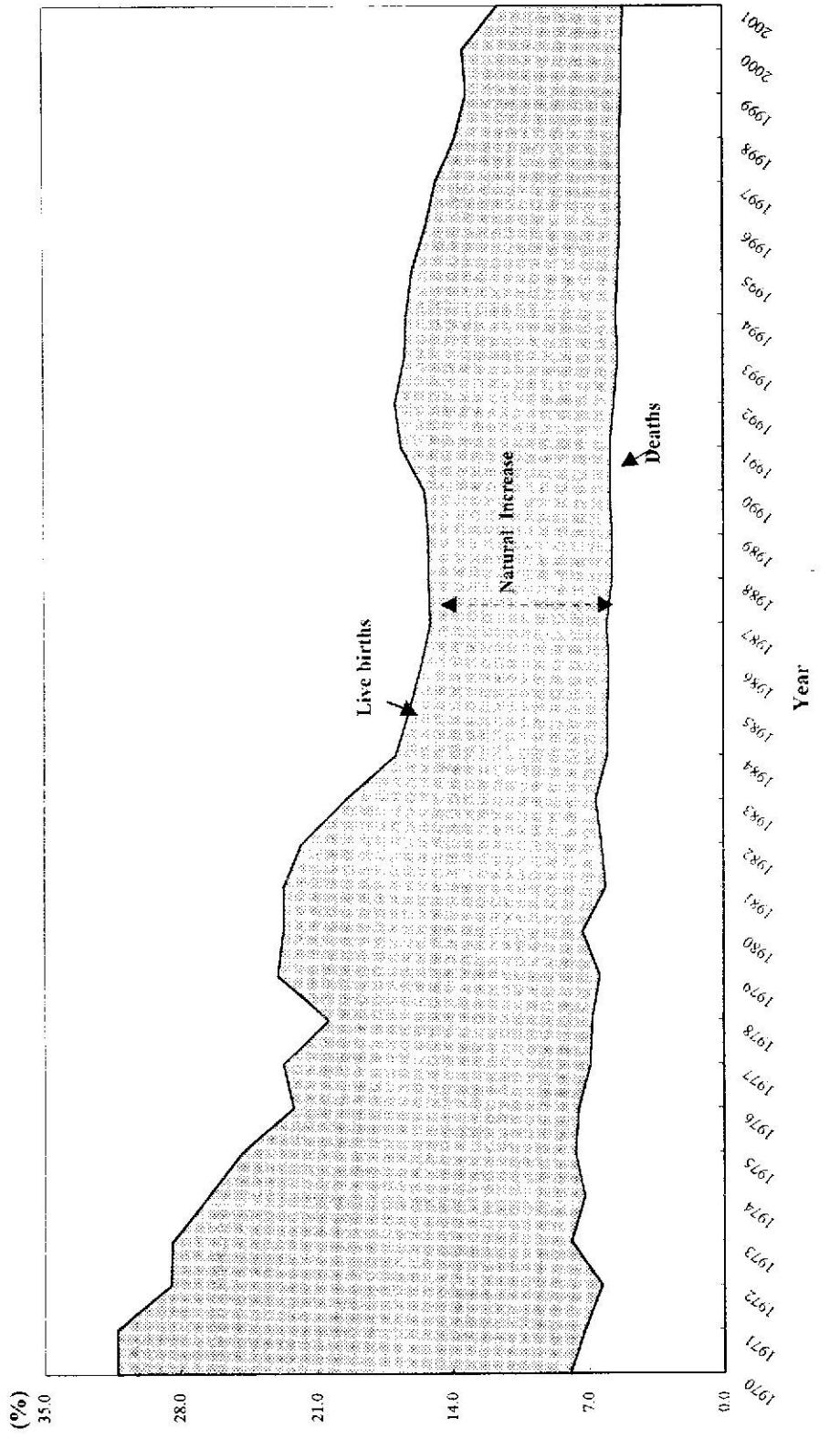


## 2. Live births and Deaths

**Table 2-1. Number and Rates of Live births and Deaths (1970-2001)**

Year	Number			Rates		
	Live births	Deaths	Natural Increase	Live births	Deaths	Natural Increase
1970	1,006,645	258,589	748,056	31.2	8.0	23.2
1971	1,024,773	237,528	787,245	31.2	7.2	24.0
1972	955,438	210,830	744,608	28.5	6.3	22.2
1973	967,647	267,909	699,738	28.4	7.9	20.5
1974	924,311	249,177	675,134	26.6	7.2	19.4
1975	874,869	270,851	604,018	24.8	7.7	17.1
1976	797,462	267,151	530,311	22.2	7.5	14.7
1977	827,079	249,767	577,312	22.7	6.9	15.8
1978	752,409	252,827	499,582	20.4	6.8	13.6
1979	864,297	240,447	623,850	23.0	6.4	16.6
1980	865,350	277,767	587,583	22.7	7.3	15.4
1981	880,310	238,017	642,293	22.7	6.1	16.6
1982	858,832	246,306	612,526	21.8	6.3	15.5
1983	778,362	263,665	514,697	19.5	6.6	12.9
1984	682,217	243,797	438,420	16.9	6.0	10.9
1985	662,510	246,121	416,389	16.2	6.0	10.2
1986	641,644	244,782	396,862	15.6	5.9	9.7
1987	629,432	248,997	380,435	15.1	6.0	9.1
1988	637,462	239,926	397,536	15.2	5.7	9.5
1989	646,197	243,576	402,621	15.2	5.7	9.5
1990	658,552	248,991	409,561	15.4	5.8	9.6
1991	718,279	249,588	468,691	16.6	5.8	10.8
1992	739,291	243,054	496,237	16.9	5.6	11.3
1993	723,934	240,468	483,466	16.4	5.4	11.0
1994	728,515	248,377	480,138	16.3	5.5	10.8
1995	721,074	248,089	472,985	16.0	5.4	10.6
1996	695,825	245,588	450,237	15.3	5.3	10.0
1997	678,402	247,938	430,464	14.8	5.3	9.5
1998	642,972	248,443	394,529	13.8	5.3	8.5
1999	616,322	246,539	369,783	13.2	5.2	8.0
2000	636,780	247,346	389,434	13.4	5.2	8.2
2001	557,228	242,730	314,498	11.6	5.1	6.5

**Graph 2-1. Rates of Live births and Deaths (1970-2001)**



### 3. Fertility

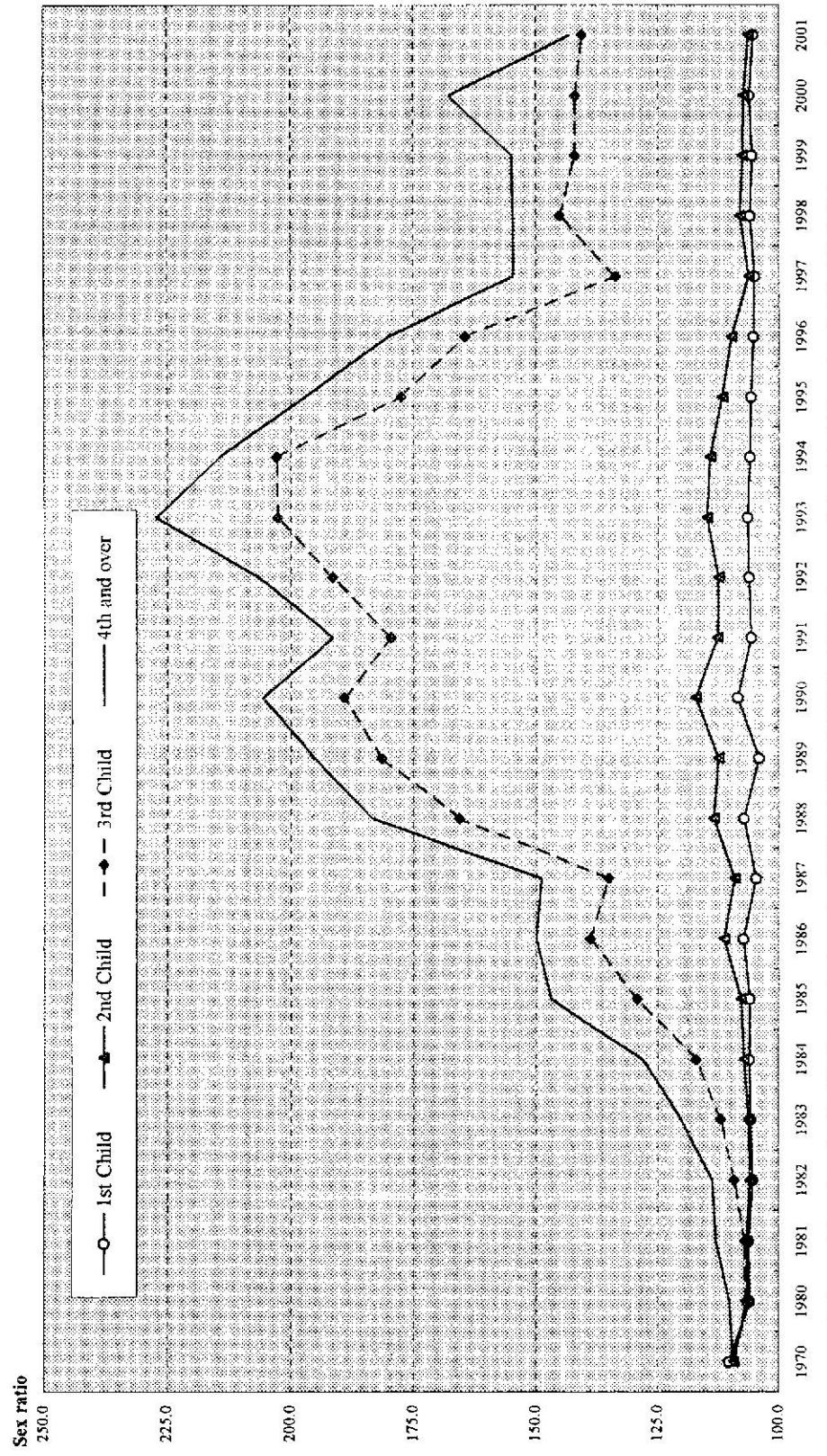
**Table 3-1. Age-specific Fertility Rates and Total Fertility Rates (1970-2001)**

Year	15~19	20~24	25~29	30~34	35~39	40~44	45~49	TFR
1970	19.3	193.1	320.6	205.7	105.9	46.0	13.1	4.5
1971	20.7	202.2	321.0	207.7	103.1	41.8	10.8	4.5
1972	19.0	185.4	295.0	193.0	89.8	34.7	8.9	4.1
1973	18.2	186.0	291.2	193.4	85.8	34.3	7.8	4.1
1974	16.7	182.5	276.4	176.4	72.1	25.8	5.8	3.8
1975	14.3	178.3	263.8	146.1	58.1	20.8	5.0	3.5
1976	15.0	159.8	239.6	119.1	46.3	16.4	4.3	3.1
1977	17.4	161.1	247.1	112.6	42.7	14.1	4.1	3.0
1978	14.1	135.9	228.4	101.8	35.4	10.9	2.8	2.6
1979	14.3	153.4	260.6	108.1	32.8	9.4	2.3	2.9
1980	12.4	135.9	242.7	114.0	40.2	15.1	5.6	2.8
1981	13.0	148.5	243.2	92.4	25.9	7.2	1.6	2.7
1982	15.0	159.1	213.9	72.5	20.0	5.3	1.3	2.4
1983	13.0	146.6	187.1	55.6	14.6	4.0	0.8	2.1
1984	11.7	129.7	159.5	42.0	10.4	2.8	0.6	1.8
1985	10.1	118.7	159.1	41.1	8.8	2.2	0.5	1.7
1986	8.7	104.2	160.0	39.6	8.3	1.9	0.5	1.6
1987	7.0	97.3	159.3	39.2	7.7	1.7	0.3	1.5
1988	5.7	92.1	163.5	41.9	7.9	1.5	0.3	1.6
1989	4.5	89.7	165.6	44.7	8.5	1.5	0.2	1.6
1990	4.2	83.2	169.4	50.5	9.6	1.5	0.2	1.6
1991	4.3	84.8	186.2	58.8	10.8	1.5	0.2	1.7
1992	4.7	82.8	188.9	65.1	12.6	1.8	0.2	1.8
1993	4.4	72.7	178.8	64.2	13.8	2.0	0.2	1.7
1994	4.0	66.0	179.6	68.0	14.7	2.2	0.2	1.7
1995	3.6	62.9	177.1	69.6	15.2	2.3	0.2	1.6
1996	3.3	58.8	167.6	71.1	15.5	2.4	0.2	1.6
1997	3.1	54.5	161.5	73.2	16.0	2.5	0.2	1.5
1998	2.9	48.0	153.4	73.2	15.8	2.5	0.2	1.5
1999	3.0	47.2	149.0	69.2	14.6	2.2	0.2	1.4
2000	2.5	39.0	150.6	84.2	17.4	2.6	0.2	1.5
2001	2.2	31.6	130.1	78.3	17.2	2.5	0.2	1.3

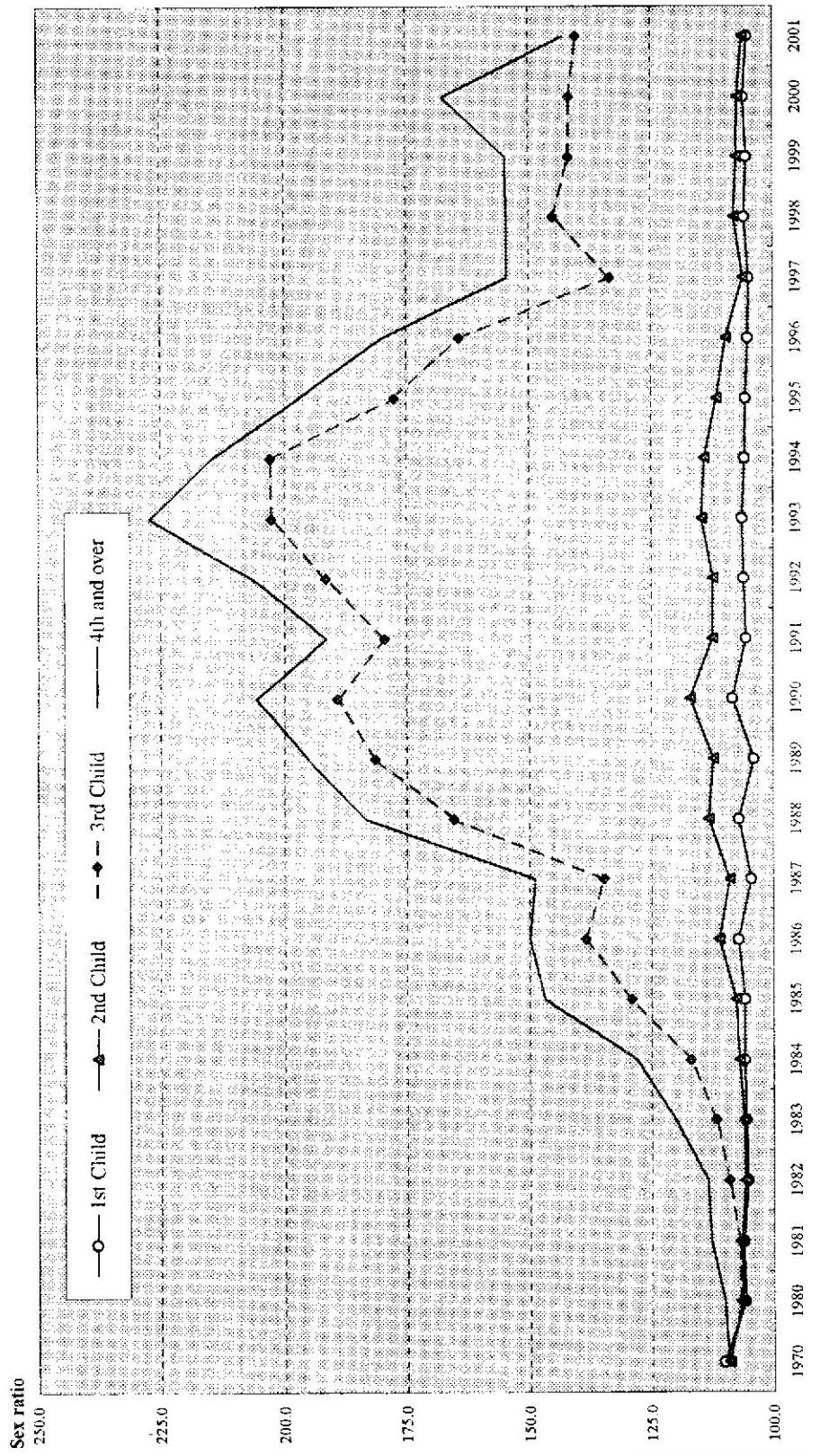
**Table 3-2. Percent distribution of Live Births and Sex ratio of Birth , by birth order (1970-2001)**

Year	Percent distribution					Sex ratio				
	total	1st Child	2nd Child	3rd Child	4th and over	total	1st Child	2nd Child	3rd Child	4th and over
1970	100.0	25.0	21.8	18.8	34.4	109.5	110.2	109.3	109.1	109.4
1980	100.0	39.7	32.1	16.7	12.3	105.3	106.0	106.5	106.9	110.2
1981	100.0	41.0	33.5	16.4	9.1	107.2	106.3	106.7	107.1	112.9
1982	100.0	41.9	35.5	14.8	7.9	106.8	105.4	106.0	109.2	113.6
1983	100.0	44.8	38.2	11.2	5.8	107.3	105.8	106.2	111.8	120.0
1984	100.0	49.4	37.8	8.5	4.3	108.3	106.1	107.2	116.9	128.1
1985	100.0	51.5	37.6	7.5	3.3	109.4	106.0	107.8	129.2	146.8
1986	100.0	53.1	37.1	7.0	2.8	111.7	107.3	111.2	138.6	149.9
1987	100.0	54.3	37.3	6.2	2.2	108.8	104.7	109.1	134.9	148.8
1988	100.0	54.2	38.1	5.9	1.8	113.3	107.2	113.3	165.4	183.3
1989	100.0	53.7	38.9	5.8	1.6	111.7	104.1	112.4	181.4	195.1
1990	100.0	53.6	38.9	6.0	1.5	116.5	108.5	117.0	189.0	205.6
1991	100.0	53.2	39.9	5.6	1.3	112.4	105.7	112.5	179.5	191.3
1992	100.0	52.0	40.4	6.3	1.2	113.6	106.2	112.4	191.4	206.3
1993	100.0	52.0	40.1	6.7	1.2	115.3	106.5	114.7	202.6	227.2
1994	100.0	49.8	41.9	7.1	1.2	115.2	106.0	114.1	202.8	214.4
1995	100.0	48.3	43.1	7.5	1.1	113.2	105.8	111.7	177.5	197.1
1996	100.0	48.4	42.6	8.0	1.0	111.6	105.3	109.8	164.2	180.0
1997	100.0	48.4	41.9	8.7	1.0	108.3	105.1	106.3	133.6	154.5
1998	100.0	48.9	41.2	8.8	1.0	110.2	106.0	108.1	145.0	154.6
1999	100.0	50.1	40.1	8.8	1.0	109.6	105.6	107.6	141.8	154.9
2000	100.0	47.2	42.4	9.4	1.0	110.2	106.2	107.4	141.7	167.5
2001	100.0	47.5	42.1	9.0	1.4	109.0	105.4	106.4	140.3	142.8

**Graph 3-2. Sex ratio of Birth , by birth order (1981-1990)**



**Graph 3-2. Sex ratio of Birth , by birth order (1981-1990)**



#### 4. Mortality

**Table 4-1. Death probability by sex and age (1995-1999)**

Male	Death probability			Decreasing Rate(%)	
	1995	1997	1999	95-97	97-99
0	0.00875	0.00741	0.00613	15.3	17.3
1	0.00292	0.00245	0.00204	16.0	16.6
5	0.00241	0.00192	0.00156	20.1	18.8
10	0.00201	0.00169	0.00130	15.6	23.2
15	0.00540	0.00473	0.00350	12.3	26.1
20	0.00630	0.00589	0.00474	6.5	19.6
25	0.00771	0.00675	0.00552	12.5	18.2
30	0.00982	0.00877	0.00727	10.7	17.1
35	0.01462	0.01309	0.01153	10.5	11.9
40	0.02279	0.02051	0.01873	10.0	8.7
45	0.03279	0.03136	0.02937	4.3	6.4
50	0.04968	0.04570	0.04151	8.0	9.2
55	0.07372	0.06795	0.06282	7.8	7.5
60	0.10790	0.09990	0.09455	7.4	5.4
65	0.16170	0.15127	0.14250	6.4	5.8
70	0.24315	0.23249	0.22005	4.4	5.4
75	0.35133	0.33997	0.33073	3.2	2.7
80	0.49751	0.48197	0.47451	3.1	1.5
85+	1.00000	1.00000	1.00000	-	-

Female	Death probability			Decreasing Rate(%)	
	1995	1997	1999	95-97	97-99
0	0.00791	0.00689	0.00591	12.8	14.2
1	0.00256	0.00209	0.00171	18.4	18.1
5	0.00165	0.00130	0.00113	21.3	13.5
10	0.00133	0.00112	0.00090	16.0	19.9
15	0.00243	0.00218	0.00174	10.5	20.1
20	0.00279	0.00250	0.00213	10.2	15.0
25	0.00315	0.00286	0.00244	9.4	14.5
30	0.00384	0.00369	0.00329	3.9	10.9
35	0.00528	0.00502	0.00458	5.0	8.7
40	0.00782	0.00712	0.00652	9.0	8.4
45	0.01150	0.01066	0.00966	7.3	9.4
50	0.01773	0.01648	0.01447	7.0	12.2
55	0.02696	0.02425	0.02222	10.1	8.4
60	0.04432	0.04002	0.03672	9.7	8.2
65	0.07583	0.07042	0.06525	7.1	7.4
70	0.13469	0.12732	0.12081	5.5	5.1
75	0.23008	0.22028	0.21372	4.3	3.0
80	0.36341	0.35209	0.35283	3.1	-0.2
85+	1.00000	1.00000	1.00000	-	-

**Table 4-2. Life expectancy at birth (1971-1999)**

Year	Both sexes	Male	Female	Difference
1971	62.33	58.99	66.07	7.08
1973	63.09	59.61	67.03	7.42
1975	63.82	60.19	67.91	7.72
1977	64.51	60.75	68.74	7.99
1979	65.17	61.28	69.51	8.23
1981	66.19	62.28	70.54	8.26
1983	67.14	63.21	71.47	8.26
1985	68.44	64.45	72.82	8.37
1987	69.76	65.78	74.04	8.26
1989	70.82	66.84	75.08	8.24
1991	71.72	67.74	75.92	8.18
1993	72.81	68.76	76.80	8.04
1995	73.53	69.57	77.41	7.84
1997	74.39	70.56	78.12	7.56
1999	75.55	71.71	79.22	7.51

**Table 4-3. Age-specific Mortality Rates by Sex (1970-2001)**

<Male>

	1970	1975	1980	1985	1990	1995	1996	1997	1998	1999	2000	2001
total	9.2	8.9	8.4	7.0	6.6	6.1	6.0	6.0	5.9	5.8	5.8	5.6
0-4	4.7	3.1	2.9	2.2	3.7	2.4	2.1	1.9	1.7	1.3	1.3	1.3
5-9	2.6	2.5	1.6	1.0	0.7	0.5	0.4	0.4	0.4	0.3	0.3	0.3
10-14	2.1	1.9	1.2	0.7	0.6	0.4	0.4	0.3	0.3	0.2	0.2	0.2
15-19	3.5	2.9	2.0	1.6	1.2	1.1	1.1	1.0	0.8	0.7	0.6	0.5
20-24	4.2	3.7	2.8	1.9	1.5	1.2	1.3	1.2	1.0	0.9	0.9	0.7
25-29	3.8	3.5	2.9	2.3	1.9	1.6	1.5	1.4	1.2	1.1	1.0	0.9
30-34	4.0	4.6	3.5	2.8	2.5	1.9	1.9	1.7	1.6	1.4	1.3	1.2
35-39	5.5	5.3	5.4	4.1	3.7	2.9	2.9	2.6	2.5	2.3	2.1	2.0
40-44	9.1	9.3	8.0	7.0	5.4	4.6	4.4	4.2	3.9	3.8	3.5	3.3
45-49	14.9	13.1	12.1	10.4	9.0	6.8	6.6	6.4	6.2	5.7	5.6	5.2
50-54	22.4	22.2	18.5	14.2	12.3	10.3	9.7	9.9	8.7	8.2	8.1	7.7
55-59	33.1	31.8	27.4	21.4	17.1	15.1	14.8	14.0	13.7	12.8	12.3	11.5
60-64	47.5	51.8	42.6	33.1	26.7	22.7	21.6	20.8	20.7	19.9	18.8	17.8
65-69	72.9	67.9	64.1	50.3	40.8	35.6	33.4	32.5	31.5	29.8	28.8	27.6
70-74	95.5	81.9	99.8	76.1	64.4	56.4	54.3	53.5	49.7	49.1	46.9	45.4
75-79	225.2	235.1	159.8	118.0	97.0	87.8	81.8	82.1	81.8	78.7	77.7	74.7
80+	-	-	357.2	240.2	187.0	156.7	153.1	155.1	154.4	152.5	148.4	140.3

<Female>

	1970	1975	1980	1985	1990	1995	1996	1997	1998	1999	2000	2001
total	6.8	6.4	6.2	5.0	5.0	4.8	4.7	4.7	4.7	4.7	4.7	4.5
0-4	4.5	2.8	2.9	2.0	3.2	2.1	1.9	1.8	1.6	1.1	1.2	1.2
5-9	2.3	2.2	1.5	0.9	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2
10-14	1.7	1.6	1.3	0.5	0.4	0.2	0.2	0.2	0.2	0.2	0.2	0.2
15-19	2.5	2.2	1.4	0.9	0.5	0.5	0.5	0.4	0.4	0.3	0.3	0.3
20-24	3.5	3.0	1.8	1.0	0.7	0.6	0.5	0.5	0.5	0.4	0.4	0.4
25-29	3.7	3.1	2.0	1.1	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.4
30-34	3.3	3.7	2.3	1.3	1.0	0.7	0.7	0.8	0.7	0.6	0.6	0.6
35-39	4.1	3.6	3.0	1.8	1.4	1.0	1.1	1.0	1.0	0.9	0.9	0.8
40-44	5.3	5.0	3.8	2.8	2.0	1.6	1.5	1.4	1.3	1.2	1.3	1.2
45-49	7.0	6.8	5.5	4.1	3.4	2.4	2.2	2.2	2.0	1.9	1.8	1.7
50-54	10.0	9.7	8.1	5.9	4.7	3.6	3.4	3.3	3.0	2.8	2.7	2.6
55-59	14.2	12.9	11.1	8.7	6.9	5.5	5.1	5.0	4.7	4.4	4.3	4.0
60-64	20.4	21.3	17.3	13.3	11.1	8.9	8.5	8.1	7.8	7.5	7.0	6.5
65-69	31.9	27.6	28.2	22.8	18.5	15.7	15.1	14.6	13.8	13.2	12.5	11.8
70-74	49.1	41.9	46.1	38.4	33.0	29.3	27.9	27.5	25.6	24.9	24.5	22.4
75-79	179.2	119.9	77.9	63.8	55.9	52.6	49.5	48.0	48.3	46.7	45.5	43.7
80+	-	-	194.8	154.1	137.1	120.8	117.5	118.6	118.1	120.2	117.9	112.7

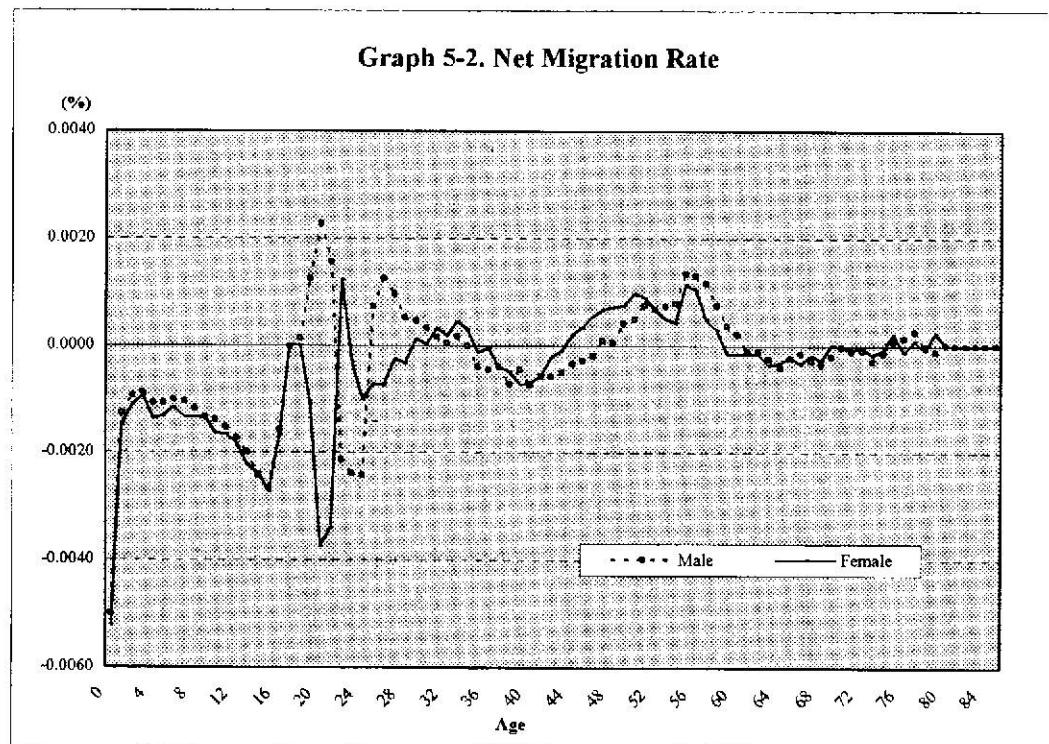
**Table 4-4. Male to Female Ratio in Mortality Rates (1970-2001)**

	1970	1975	1980	1985	1990	1995	1996	1997	1998	1999	2000	2001
<b>Total</b>	<b>134.5</b>	<b>140.1</b>	<b>135.3</b>	<b>138.7</b>	<b>133.3</b>	<b>128.6</b>	<b>129.7</b>	<b>127.2</b>	<b>126.9</b>	<b>124.3</b>	<b>123.7</b>	<b>124.1</b>
<b>Male</b>	<b>134.0</b>	<b>140.6</b>	<b>139.1</b>	<b>138.8</b>	<b>137.3</b>	<b>136.2</b>	<b>139.8</b>	<b>137.8</b>	<b>136.5</b>	<b>137.6</b>	<b>138.3</b>	<b>137.7</b>
<b>Female</b>	<b>114.1</b>	<b>115.0</b>	<b>106.6</b>	<b>118.3</b>	<b>118.0</b>	<b>116.3</b>	<b>117.5</b>	<b>117.1</b>	<b>117.0</b>	<b>114.4</b>	<b>115.1</b>	<b>119.4</b>
<b>15-19</b>	<b>124.5</b>	<b>139.1</b>	<b>108.8</b>	<b>138.3</b>	<b>139.2</b>	<b>139.4</b>	<b>138.1</b>	<b>138.8</b>	<b>138.3</b>	<b>138.7</b>	<b>134.7</b>	<b>133.7</b>
<b>20-24</b>	<b>129.6</b>	<b>139.3</b>	<b>136.0</b>	<b>138.2</b>	<b>138.5</b>	<b>138.9</b>	<b>139.5</b>	<b>139.7</b>	<b>139.0</b>	<b>138.3</b>	<b>139.8</b>	<b>137.6</b>
<b>25-29</b>	<b>120.1</b>	<b>122.8</b>	<b>151.5</b>	<b>125.1</b>	<b>139.2</b>	<b>131.2</b>	<b>134.4</b>	<b>137.6</b>	<b>137.9</b>	<b>136.1</b>	<b>135.6</b>	<b>135.6</b>
<b>30-34</b>	<b>102.1</b>	<b>112.3</b>	<b>142.3</b>	<b>106.6</b>	<b>110.8</b>	<b>111.5</b>	<b>111.0</b>	<b>111.4</b>	<b>111.5</b>	<b>111.1</b>	<b>114.5</b>	<b>118.1</b>
<b>35-39</b>	<b>120.9</b>	<b>124.8</b>	<b>150.5</b>	<b>123.1</b>	<b>120.1</b>	<b>125.2</b>	<b>126.8</b>	<b>126.5</b>	<b>126.7</b>	<b>126.6</b>	<b>121.7</b>	<b>117.0</b>
<b>40-44</b>	<b>133.6</b>	<b>146.1</b>	<b>180.6</b>	<b>232.3</b>	<b>265.7</b>	<b>280.5</b>	<b>267.8</b>	<b>262.7</b>	<b>255.7</b>	<b>247.6</b>	<b>246.9</b>	<b>254.2</b>
<b>45-49</b>	<b>171.1</b>	<b>184.8</b>	<b>212.1</b>	<b>247.4</b>	<b>264.5</b>	<b>289.0</b>	<b>284.9</b>	<b>289.4</b>	<b>289.7</b>	<b>305.4</b>	<b>278.2</b>	<b>282.9</b>
<b>50-54</b>	<b>211.0</b>	<b>193.6</b>	<b>220.2</b>	<b>255.5</b>	<b>264.5</b>	<b>287.8</b>	<b>291.7</b>	<b>294.1</b>	<b>306.4</b>	<b>301.8</b>	<b>312.9</b>	<b>303.6</b>
<b>55-59</b>	<b>225.0</b>	<b>228.5</b>	<b>227.6</b>	<b>242.0</b>	<b>263.1</b>	<b>282.6</b>	<b>281.4</b>	<b>275.2</b>	<b>284.4</b>	<b>292.2</b>	<b>295.9</b>	<b>292.4</b>
<b>60-64</b>	<b>232.9</b>	<b>247.6</b>	<b>247.3</b>	<b>245.5</b>	<b>248.9</b>	<b>273.0</b>	<b>291.8</b>	<b>279.3</b>	<b>291.3</b>	<b>289.8</b>	<b>285.7</b>	<b>285.4</b>
<b>65-69</b>	<b>233.3</b>	<b>242.6</b>	<b>245.9</b>	<b>248.8</b>	<b>240.8</b>	<b>253.5</b>	<b>254.9</b>	<b>257.3</b>	<b>266.9</b>	<b>266.8</b>	<b>267.4</b>	<b>276.1</b>
<b>70-74</b>	<b>228.1</b>	<b>245.7</b>	<b>227.5</b>	<b>221.1</b>	<b>220.8</b>	<b>226.4</b>	<b>220.5</b>	<b>222.2</b>	<b>228.4</b>	<b>225.3</b>	<b>229.9</b>	<b>233.9</b>
<b>75-79</b>	<b>194.5</b>	<b>255.1</b>	<b>216.5</b>	<b>198.4</b>	<b>195.4</b>	<b>192.4</b>	<b>194.8</b>	<b>194.9</b>	<b>194.3</b>	<b>197.0</b>	<b>191.9</b>	<b>202.4</b>
<b>80+</b>	<b>125.7</b>	<b>196.0</b>	<b>205.3</b>	<b>185.0</b>	<b>173.3</b>	<b>167.1</b>	<b>165.1</b>	<b>171.0</b>	<b>169.4</b>	<b>168.4</b>	<b>170.8</b>	<b>170.9</b>
				<b>183.4</b>	<b>155.9</b>	<b>136.4</b>	<b>129.7</b>	<b>130.4</b>	<b>130.7</b>	<b>130.7</b>	<b>126.9</b>	<b>125.9</b>
												<b>124.5</b>

## 5. Migration

**Table 5-1. Net International Migration (1995-2000)**

	1995	1996	1997	1998	1999	2000	(Thousands) sum
Total	-23	7	-10	-98	-3	11	-115
Koreans	-27	-53	-44	-41	-68	-43	-276
Foreigners	4	60	35	-57	65	54	161



**Table 5-2. Net Migration Rate (1995-2000)**

Age	Male	Female	Age	Male	Female
0	-0.0050	-0.0052	43	-0.0005	-0.0001
1	-0.0013	-0.0015	44	-0.0003	0.0002
2	-0.0009	-0.0011	45	-0.0003	0.0003
3	-0.0009	-0.0009	46	-0.0002	0.0005
4	-0.0011	-0.0014	47	0.0001	0.0007
5	-0.0011	-0.0013	48	0.0001	0.0007
6	-0.0010	-0.0012	49	0.0004	0.0007
7	-0.0010	-0.0013	50	0.0005	0.0010
8	-0.0012	-0.0013	51	0.0008	0.0009
9	-0.0013	-0.0013	52	0.0007	0.0007
10	-0.0014	-0.0016	53	0.0007	0.0005
11	-0.0015	-0.0017	54	0.0008	0.0004
12	-0.0017	-0.0018	55	0.0013	0.0011
13	-0.0020	-0.0022	56	0.0013	0.0010
14	-0.0024	-0.0024	57	0.0012	0.0005
15	-0.0027	-0.0027	58	0.0007	0.0003
16	-0.0016	-0.0017	59	0.0004	-0.0001
17	0.0000	0.0000	60	0.0002	-0.0001
18	0.0001	0.0000	61	-0.0001	-0.0002
19	0.0012	-0.0011	62	-0.0001	-0.0001
20	0.0023	-0.0037	63	-0.0002	-0.0004
21	0.0016	-0.0034	64	-0.0004	-0.0003
22	-0.0021	0.0012	65	-0.0002	-0.0002
23	-0.0024	-0.0003	66	-0.0001	-0.0003
24	-0.0024	-0.0010	67	-0.0003	-0.0002
25	0.0007	-0.0007	68	-0.0004	-0.0003
26	0.0013	-0.0007	69	-0.0002	0.0000
27	0.0010	-0.0003	70	0.0000	0.0000
28	0.0005	-0.0003	71	-0.0001	-0.0001
29	0.0005	0.0001	72	-0.0001	0.0000
30	0.0003	0.0000	73	-0.0003	-0.0002
31	0.0002	0.0003	74	-0.0001	-0.0001
32	0.0000	0.0002	75	0.0001	0.0002
33	0.0002	0.0005	76	0.0001	-0.0001
34	0.0000	0.0003	77	0.0003	0.0001
35	-0.0004	-0.0001	78	0.0000	-0.0001
36	-0.0004	0.0000	79	-0.0001	0.0002
37	-0.0004	-0.0004	80	0.0000	0.0000
38	-0.0007	-0.0005	81	0.0000	0.0000
39	-0.0004	-0.0007	82	0.0000	0.0000
40	-0.0007	-0.0007	83	0.0000	0.0000
41	-0.0006	-0.0006	84	0.0000	0.0000
42	-0.0006	-0.0002	85+	0.0000	0.0000

# Vital Statistics

International  
Cooperation



통계청

Korea National Statistical Office

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## The Cooperation Project

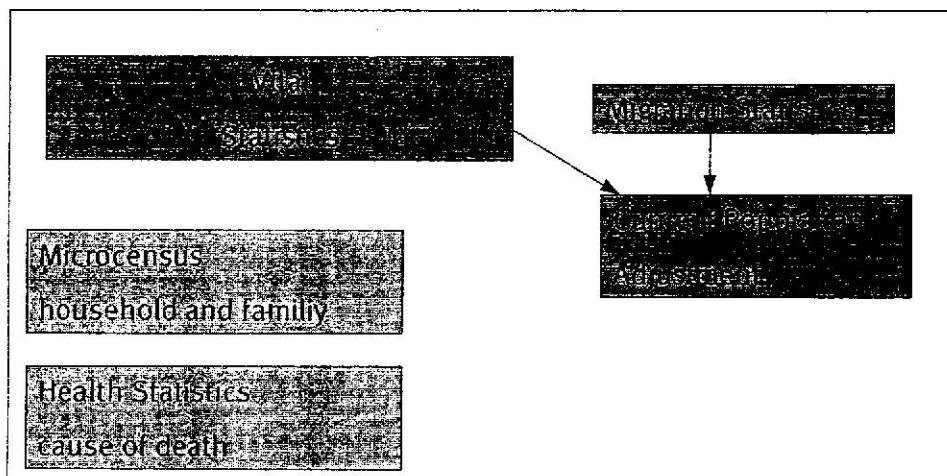
International cooperation in Vital Statistics between the  
National Statistical Offices of Korea and Germany

Start of the project: August 2001, Taejon

Continuation: October 2002, Wiesbaden

*„The aim of the cooperation project is to advance the vital statistics in Korea and Germany and to establish a comprehensive exchange of knowledge“*

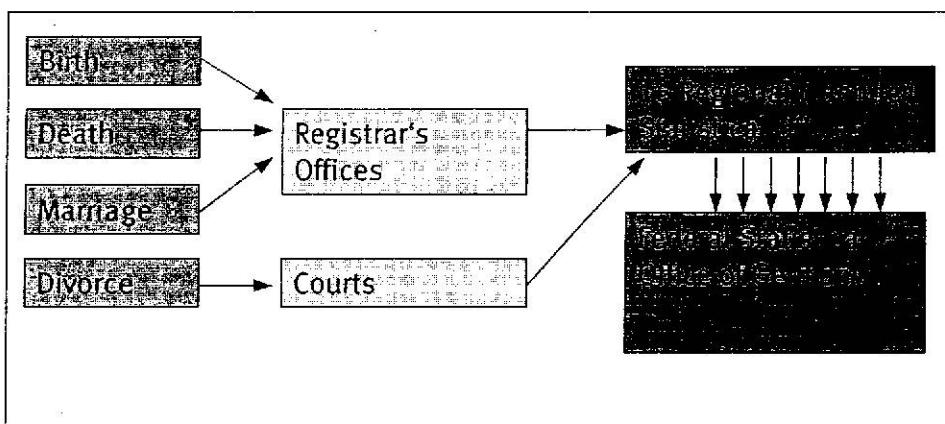
## Vital Statistics in Germany



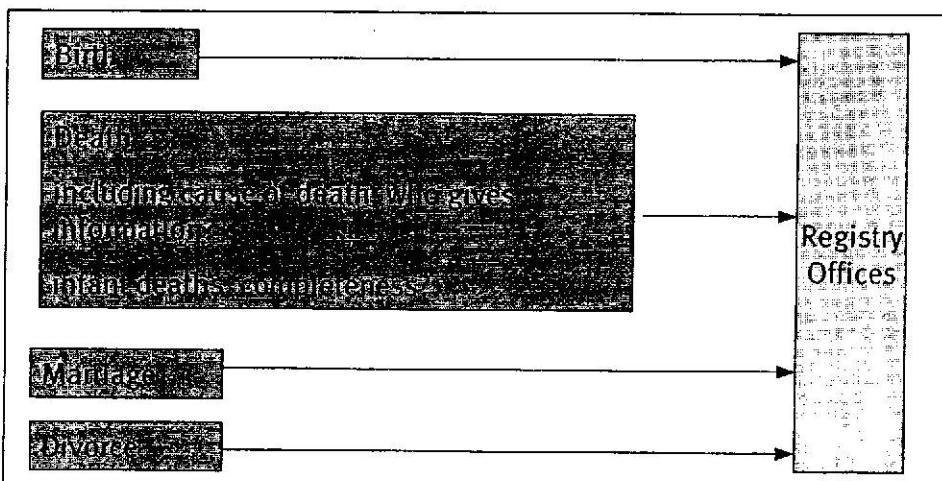
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Folie 3

## Vital Statistics in Germany



## Vital Statistics in Korea



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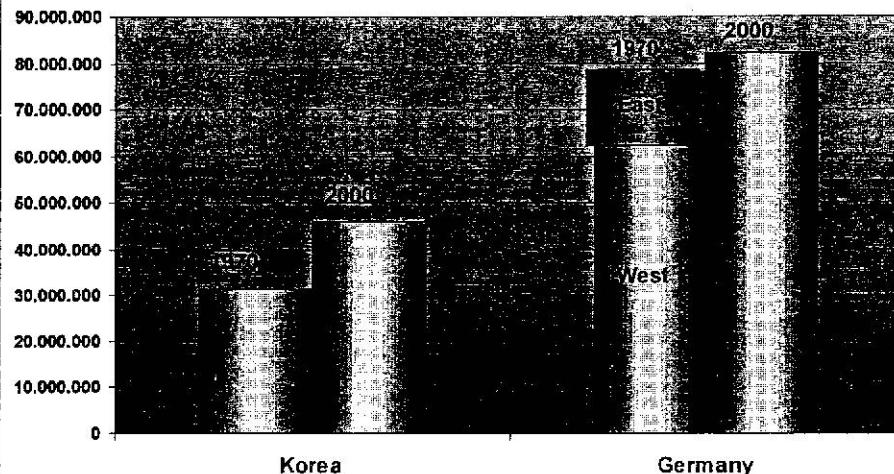
## Vital Statistics in Comparison

### The demographic situation in Korea and Germany

- Population
- CDR/CBR
- Natural increase
- Population pyramid
- Life expectancy at birth
- Marriages
- Divorces

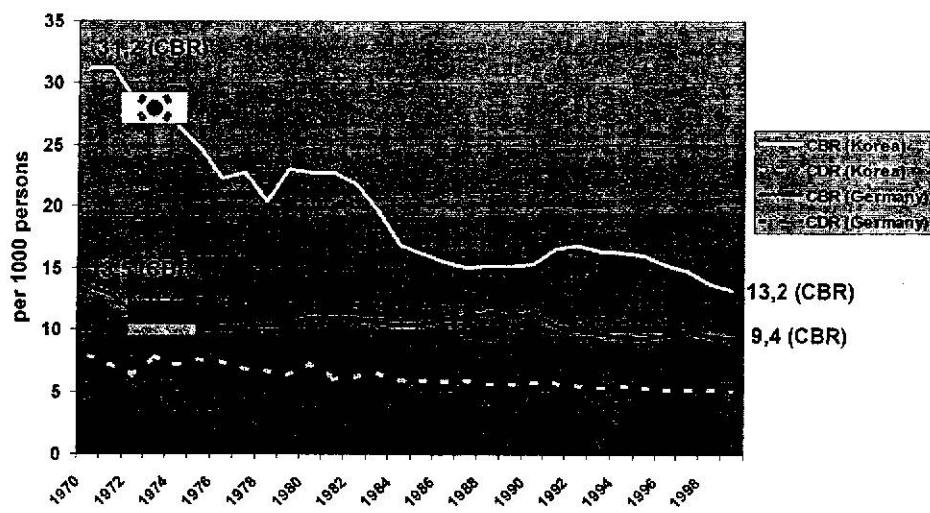
### The Effect of the Reunification in Germany

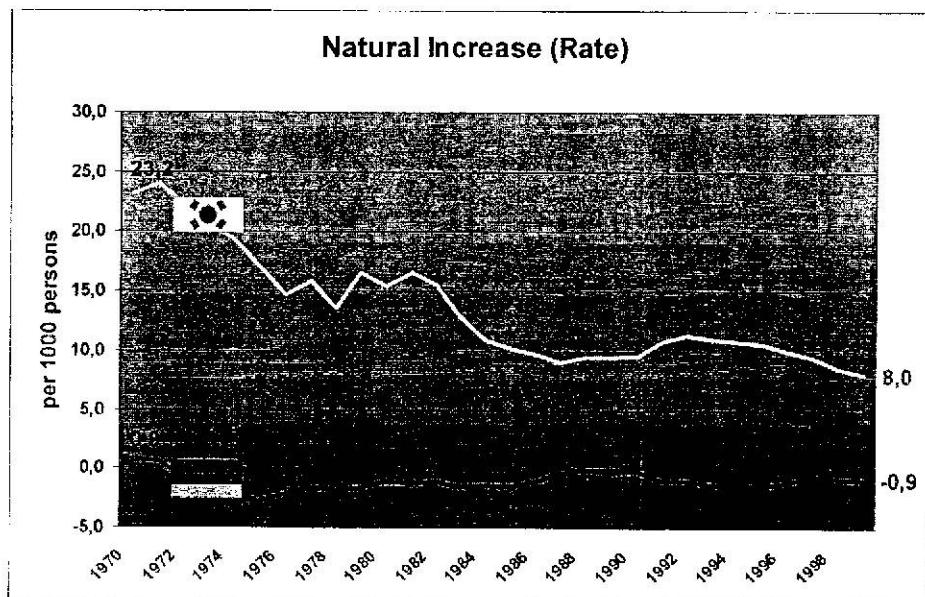
- CDR/CBR, Marriages and Divorces before and after 1990

**Population**

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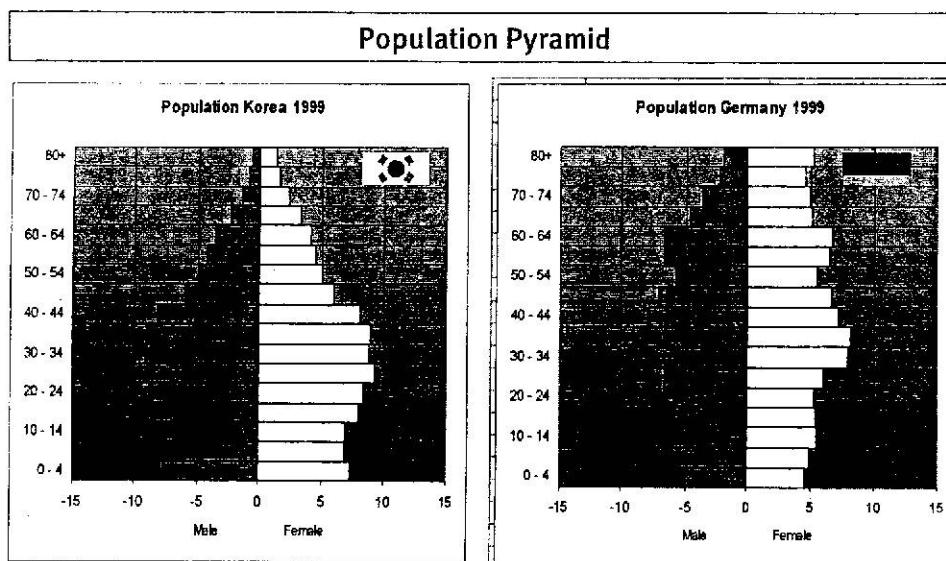
Folie 7

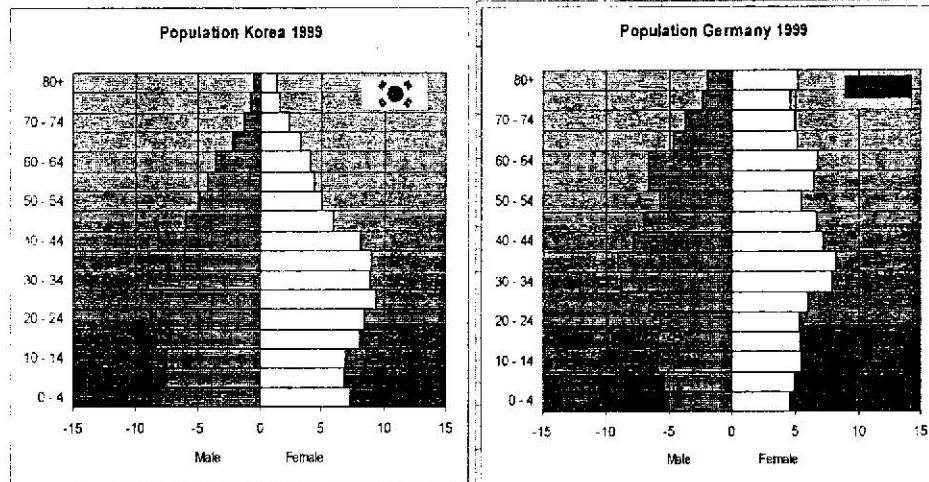
**Crude Birth Rate (CBR) and Crude Death Rate (CDR)**



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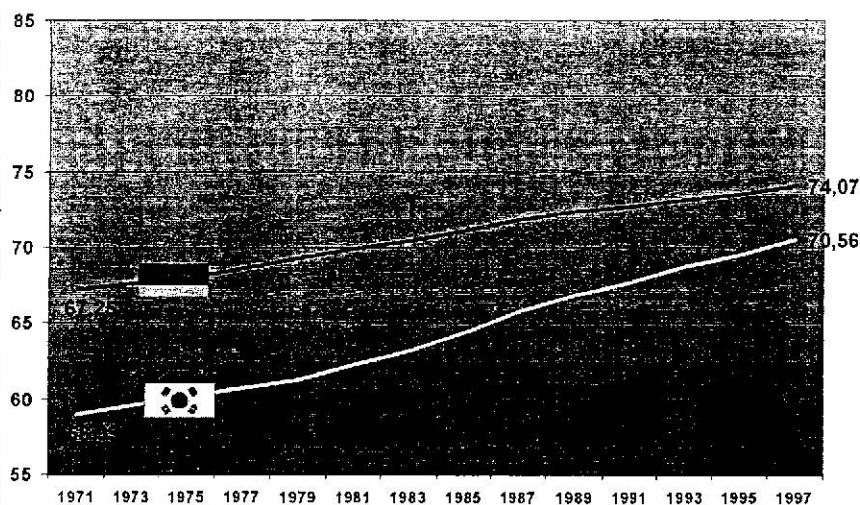
Folie 9

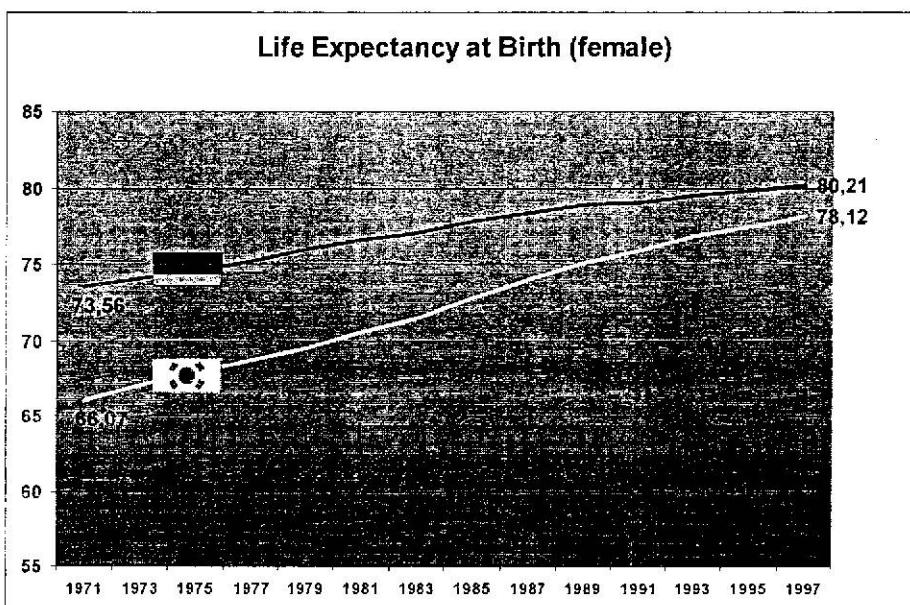


**Population Pyramid**

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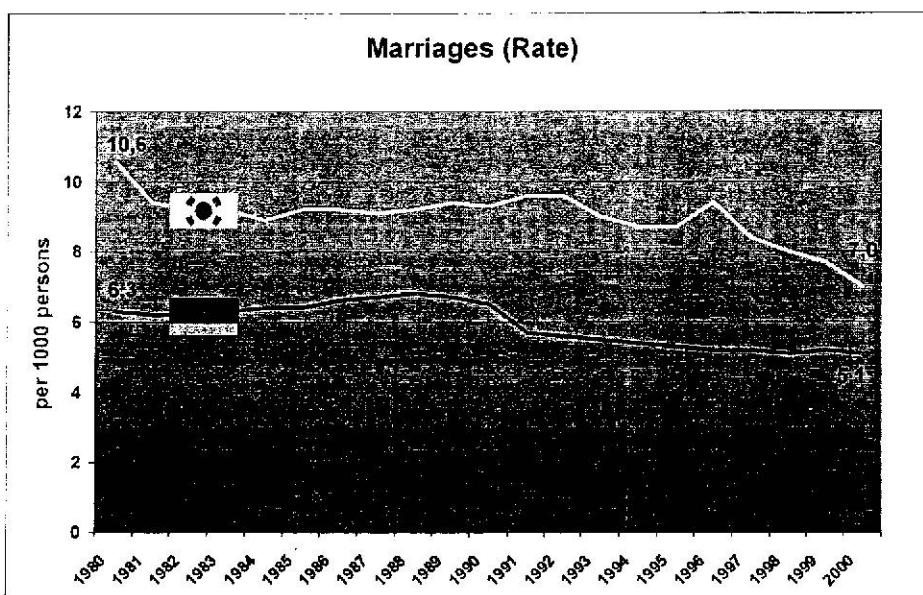
Folie 10

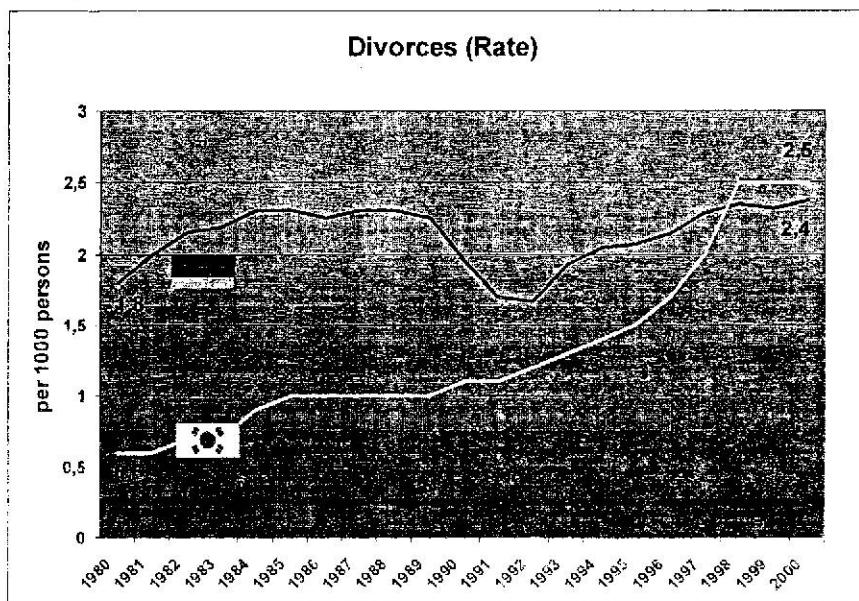
**Life Expectancy at Birth (male)**



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Folie 12





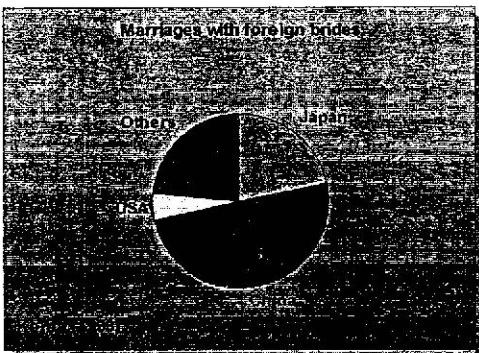
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Folie 14

### Mean Age at First Marriage

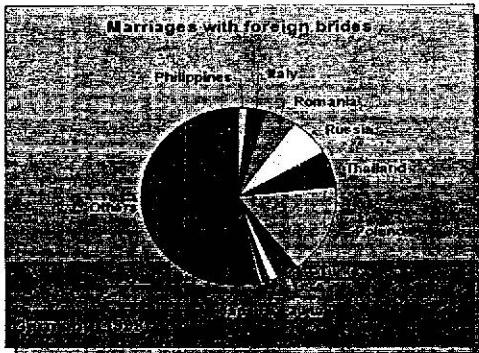
	Korea	Germany	
Brides	26.5	28.4	2000
Spouse going	29.3	31.2	

### Marriages with Foreign Brides



Korea

Total: 5775



Germany

Total: 32335

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## Vital Statistics: Projections

Korea

Population is estimated to rise from 47 million in 2000 to over 50 million in 2023 before turning to a decrease.

Life expectancy at birth is estimated to reach 80.0 years for males and 86.2 years for females in 2050.

Germany

Population is estimated to decrease from 82.3 million in 2000 to 65-70 million in 2050.

Life expectancy at birth is estimated to reach 78.1 years for males and 84.5 years for females in 2050.

# Germany: Effect of the Reunification

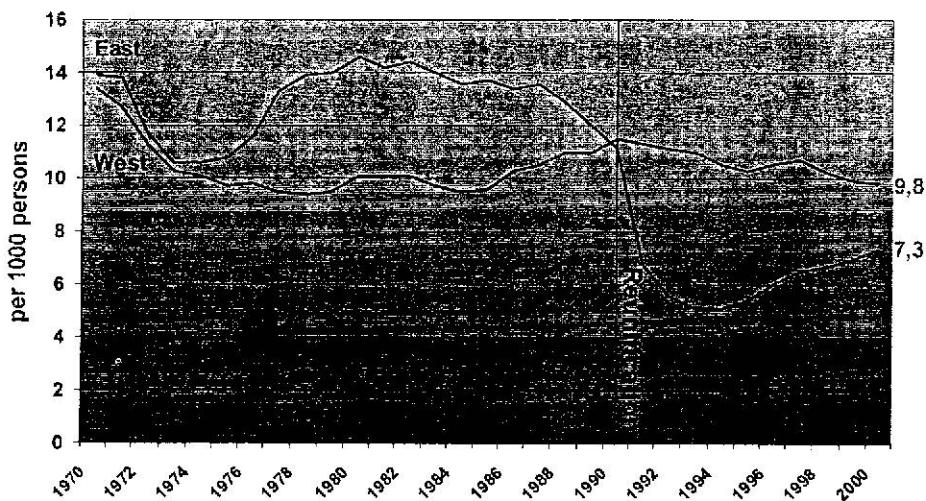
## The change of the demographic structure in 1990

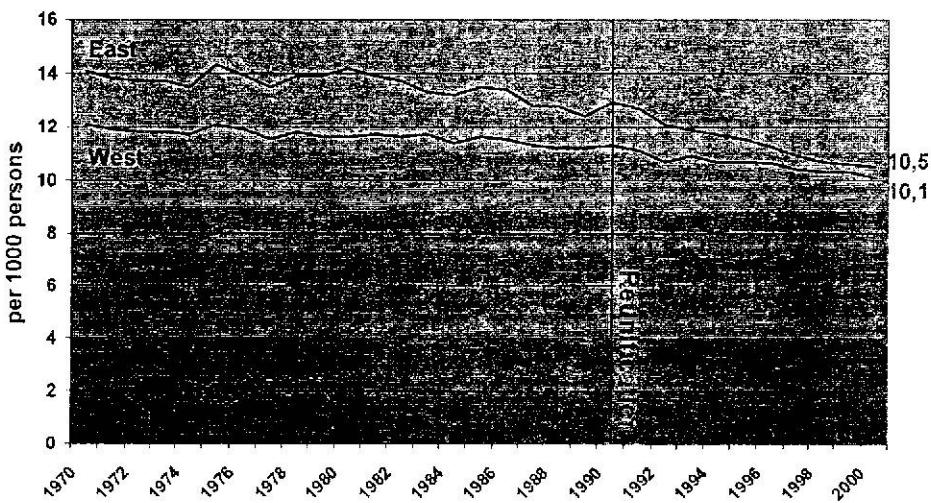
- The uncertain situation led to a sharp decrease of births and marriages and - intensified by new legal regulations - of divorces in East-Germany
- East-Germany's population was younger than West-Germany's

## The demographic structure in 2000

- East-Germany adapted the behaviour of West-Germany
- The gap between East- and West-Germany in births, deaths, marriages and divorces has narrowed
- Life expectancy grew faster in East-Germany than in West-Germany

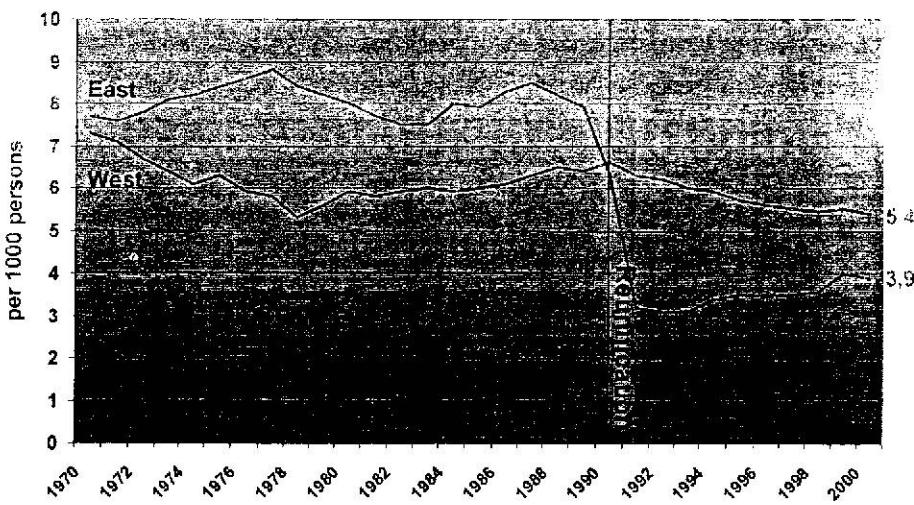
### CBR West- and East-Germany



**CDR West- and East-Germany**

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Folie 20

**Marriages West- and East-Germany**

## East-Germany: Integration of Statistics

- Adoption of West-Germany's system and methods
  - Definitions and regulations concerning vital statistics came into effect with the day of reunification
- „Mixed“ results for 1990
- Data for whole Germany are available back to 1950

## Germany: Production of Vital Statistics

Visit of Statistical Office of the Federal State of Hessen

## Next step in the cooperation project

**Aim: Release of a publication about the demographic development in Korea and Germany**

- Definition of statistical items and period
- Presentation of the development in each country
- Comparison of the development in both countries

# PROJECT: COMPARISON OF ECO-EFFICIENCIES BETWEEN SOUTH KOREA AND GERMANY

October 2002

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1 

## Comparison of Eco-Efficiencies between South Korea and Germany

1. Introduction
2. National economy and environmental factors
3. Carbondioxid-emissions by economic activities
4. Conclusion

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## Eco-Efficiency:

**Definition:** Efficiency with which ecological resources are used to meet human needs.

It is expressed as the ratio of an output - the value of products and services produced by a firm, a sector or the economy as a whole- to the input - the sum of environmental pressures generated by the firm, sector or economy.

**Measuring:** Depending on identifying indicators of both, input and output.

Source: World Business Council for Sustainable Development (WBCSD)

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Table 1: Population and gross domestic product

Parameter	unit	Germany		South Korea	
		1991	2001	1991	2001
Gross domestic product <sup>1)</sup>	Bil. US-\$	2.238	2.589	373	639
Population	Mio.	80,0	82,4	43,3	47,3
Gross domestic product per capita <sup>1)</sup>	1.000 US-\$/ capita	28,0	31,4	8,6	13,5

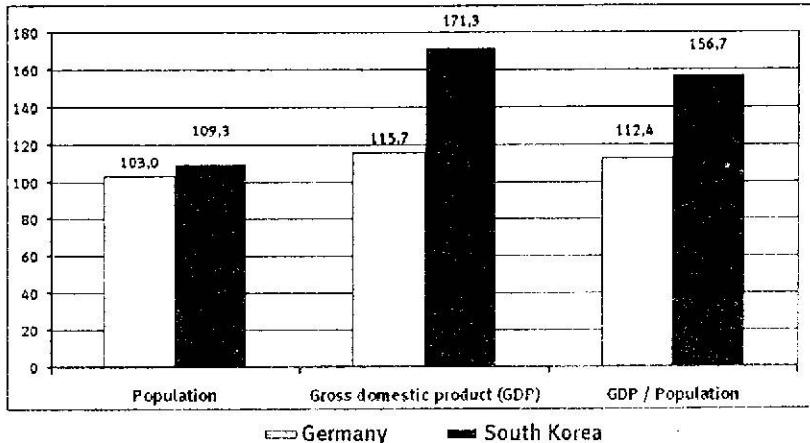
1) at 1995 prices and exchange rates

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Figure 1: Development of population and gross domestic product  
1991=100

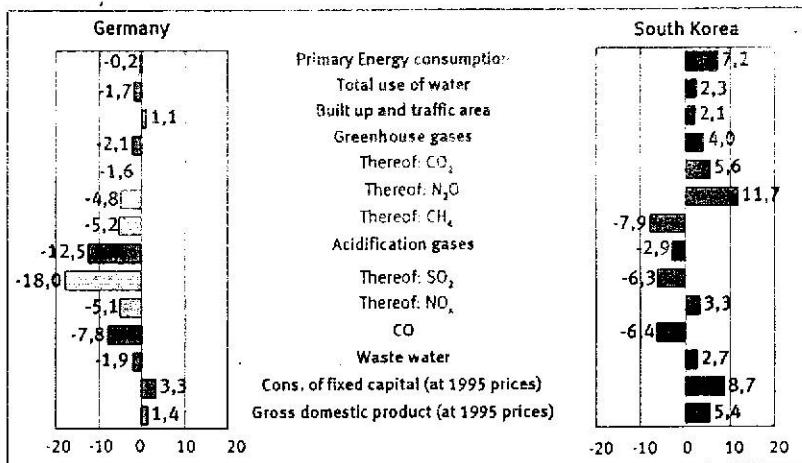


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Figure 2: Use of environmental factors for economic purposes  
Average annual change rate 1991 - 1999 in %



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## Productivity

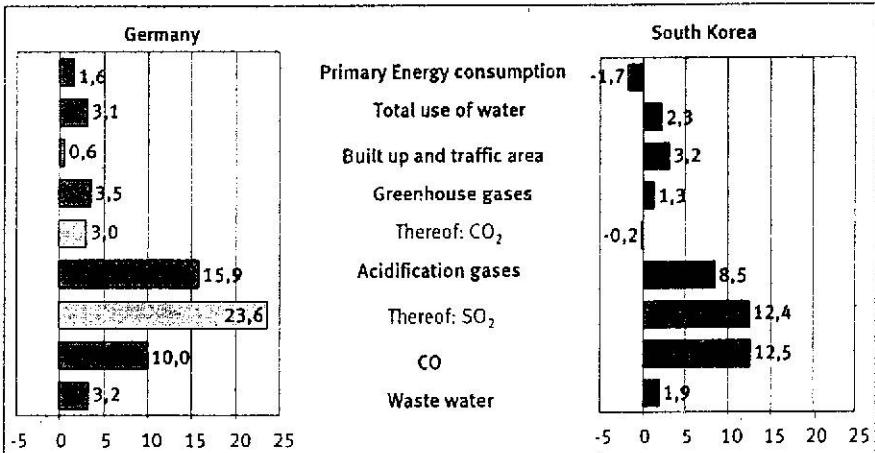
The productivity of an input factor indicates how much economic output is produced by using one unit of the factor concerned.

$$\text{Productivity} = \frac{\text{Gross domestic product (real)}}{\text{Input factor}}$$

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**Figure 3: Change of environmental productivities 1991 - 1999**  
 Average annual change rate in %



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## Differences in growth of Eco-Efficiency

South Korea: Increase of environmental pressure factors mainly because of a higher economic growth

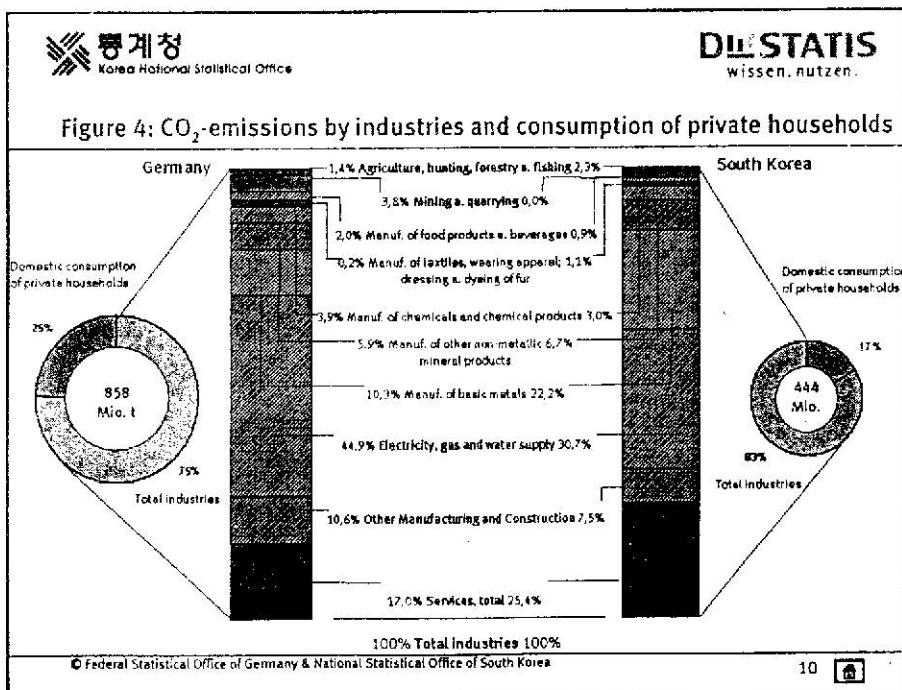
→ Lower growth of productivities

Germany: Decrease of environmental pressure factors and smaller economic growth

→ Higher growth of productivities

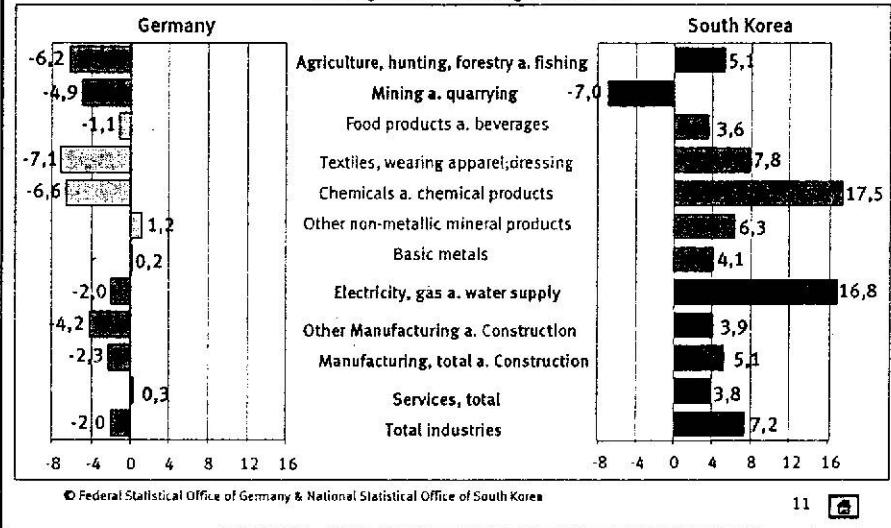
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10 

Figure 5: Direct CO<sub>2</sub>-emissions by industries 1991-1999  
Average annual change rate in %

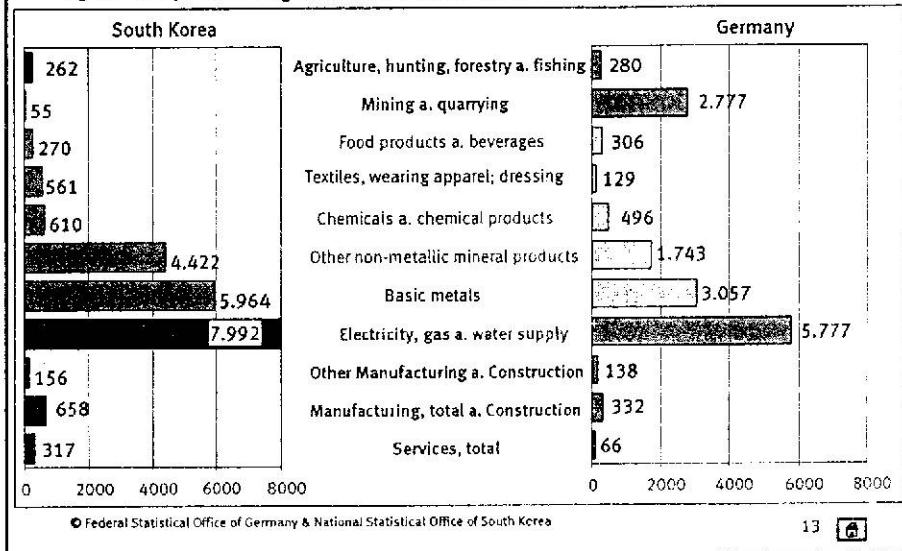


11

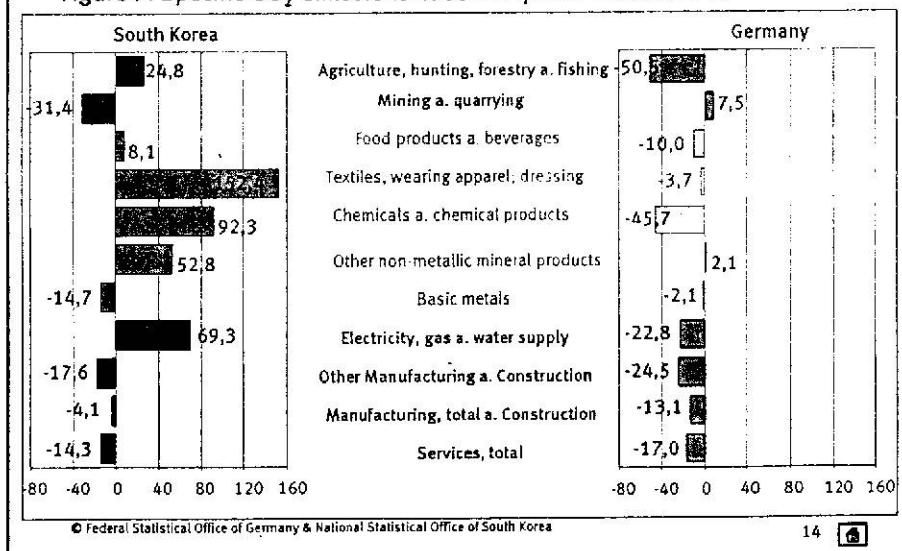
## Intensity

The specific CO<sub>2</sub>-emission (CO<sub>2</sub>-intensity) of an industry indicates how much CO<sub>2</sub>-emissions were produced to obtain one unit of the economic output (gross value added) produced there.

$$\text{Specific CO}_2\text{-emissions} = \frac{\text{CO}_2\text{-emissions}}{\text{Gross value added}}$$

Figure 6: Specific CO<sub>2</sub>-emissions 1999 in kg/1.000 US-\$


13


 Figure 7: Specific CO<sub>2</sub>-emissions 1999 compared to 1991 in %


14



## Specific CO<sub>2</sub>-emissions (CO<sub>2</sub>-Intensity)

Germany: Lower specific CO<sub>2</sub>-emissions and reduction of specific CO<sub>2</sub>-emissions in most sectors over time

South Korea: Higher specific CO<sub>2</sub>-emissions and non-uniform development of specific CO<sub>2</sub>-emissions over time

### Result:

Germany: General reduction of CO<sub>2</sub>-emissions by high intensity effect

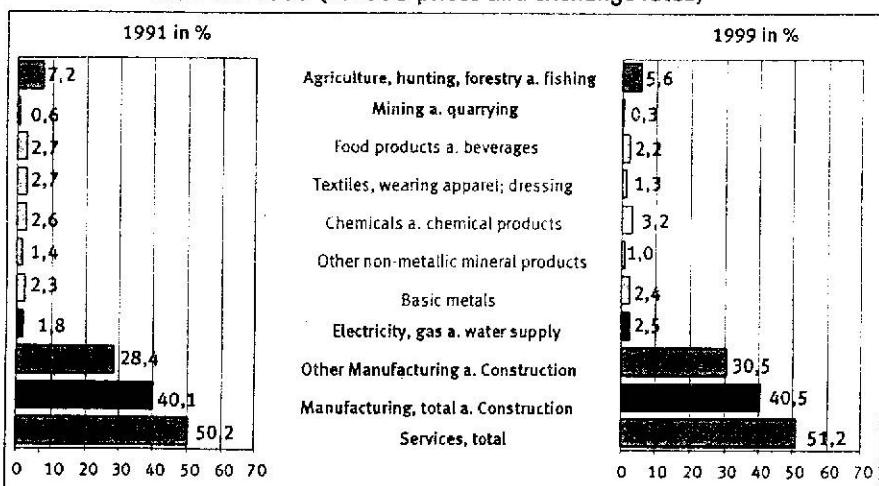
South Korea: No significant influence of intensity effect on development of CO<sub>2</sub>-emissions

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Figure 8: Gross value added by industries in South Korea  
1991 and 1999 (at 1995 prices and exchange rates)

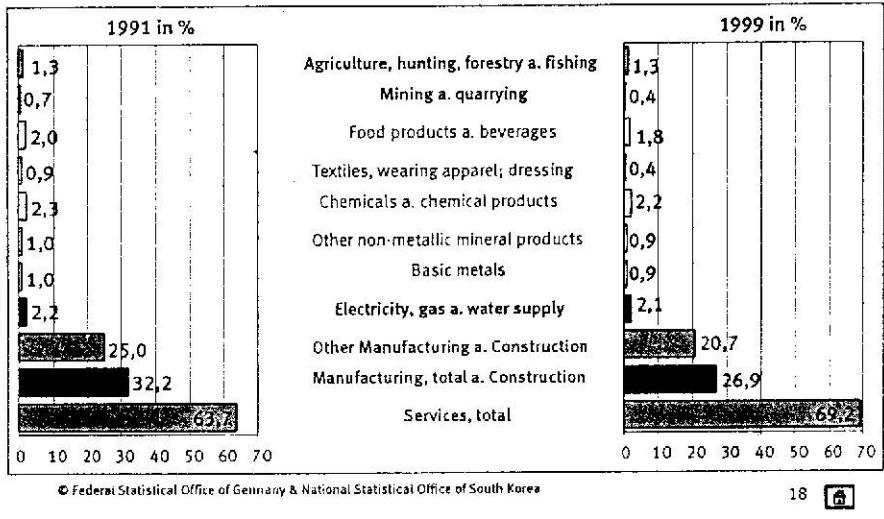


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Figure 9: Gross value added by industries in Germany  
1991 and 1999 (at 1995 prices and exchange rates)



18

## Economic structure

Germany: Lower share and decrease of CO<sub>2</sub>-emission-intensive industries over time

South Korea: Higher share and insignificant decrease of CO<sub>2</sub>-emission-intensive industries over time

**Result:**

Germany: General reduction of CO<sub>2</sub>-emissions by strong structural effect

South Korea: No significant influence of a structural effect on the development of CO<sub>2</sub>-emissions

## Conclusion

### Environmental factors:

Germany: Higher growth of productivities

South Korea: Lower growth of productivities

### CO<sub>2</sub>-emission by branches:

Germany: Decrease of CO<sub>2</sub>-intensity, supported by a strong structural effect and a general decrease of CO<sub>2</sub>-intensity by branches

South Korea: Insignificant influence of structural change and change of CO<sub>2</sub>-intensity by branches on general CO<sub>2</sub>-intensity

→ **Eco-Efficiency:** General higher increase in Germany and general lower increase in South Korea



# Compilation of Korean basic data and actual state of work

by Jung Su CHOI, Korea National Statistical Office

Wiesbaden / Germany, October 21, 2002



Compilation of Korean basic data

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## Overview

1. Gathering of data used for co-operation project
  - Background
  - Concept
  - Coverage of Korean production factors
  - Methodology and difficulties
  - Calculation methods for the environmental production factors
2. Project realization and actual state of work
  - Project realization
  - Actual state of work
3. Further steps regarding co-operation



Compilation of Korean basic data

2

## 1. Gathering of data used for co-operation project

### • Background

In Korea, in the past ten years there has been a number of efforts to reduce environmental pressures and at least de-coupling economic growth and growth of pressure on the environment, and for this provide of basic environment statistics on air pollution emission, waste, wastewater have been carried out by Ministry of Environment.

- Recently, Ministry of Environment (MOE) and National Statistical Office (NSO) considered a plan of project to develop indicators to measure the de-coupling of economic growth from environmental degradation as a part of Korean Environmental Economic Accounting (KEEA).
- Concerning this background, it is very useful comparison of data for 'Eco-efficiency' indicators as a pilot research project between two countries.

### • Concept

The objectives of the gathering of data used for co-operation project are;

- to show the relationship between economic activities and environmental pressures by means of the output side of environmental burdens regarding consumption of natural resources, emission of residuals and land use related to gross domestic product.
- to integrate nature as one of the factors of production in the economy.
- to carry out an analysis with these data which compares the environmental performance of both countries.

The concepts for compilation of Korean basic data used for comparable statistical figures on the co-operation project have been;

- taken from the concepts recommendations in the new SEEA 2000 of the UN
- arranged according to the concepts of the German Environmental Economic Accounting (GEEA).

- Coverage of Korean production factors

< Environmental production factors >

- Primary Energy Consumption; for the years 1991-1999
- Total use of water; the years 1991, 1994, 1996, 1998
- Wastewater; for the years 1991-1999
- Greenhouse gases (CO<sub>2</sub>, N<sub>2</sub>O, CH<sub>4</sub>); for the years 1991-1999
- Acidification gases (SO<sub>2</sub>, NO<sub>x</sub>); for the years 1991-1999
- CO; for the years 1991-1999
- Built-up and traffic area ; for the years 1991-1999

< Other production factors; for the years 1991-1999 >

- Hours worked (excluding holidays)
- Consumption of fixed capital
- Gross domestic product



- Methodology and difficulties

Parallel to the approach applied in national accounting, the results of Korean production factors are not only obtained directly through primary statistics but also by utilizing all available statistical sources from institutions.

- The results of the basic statistics are adjusted to the definitions and concepts used for co-operation project.
- It was not difficult compilation of the economic factors such as GDP, hours worked and consumption of fixed capital used for co-operation project for the years 1991-1999.
- However, compilation of environmental production factors have some problem which was definition, coverage and especially in a detailed breakdown by industries regarding data quality of CO<sub>2</sub>.



- Calculation methods for the environmental production factors
- Direct air emissions of the various air pollutants regarding green house gases, acidification gases and CO are calculated for the economic sectors and households by means of energy consumption from 'database of energy balance' by Korea Energy Economic Institute (KEEI) and 'specific emission coefficients' by Korean Environmental Agency (KEA) for the years 1991-1999.
- Build-up land and land used for traffic are provided by Ministry of Construction & Transport (MOCT), and coverage of build-up and traffic area are composed of area on building and adjacent, plant used for industrial, recreation used for sport, recreation and leisure, traffic used for road and rail and cemetery.
- The quantity of total use of water are compiled by Ministry of Construction & Transport every two year, and are composed of used domestic water, industrial water, agriculture water and maintenance water.



## 2. Project realization and actual state of work

### • Project realization

Many aspects of the environmental problem have a global problem. Therefore the NSO of Korea think co-operation project could be very useful to compare the eco-efficiency between two countries.

However, there was some difficulties to carry out for successful co-operation project regarding Korean basic data;

- Quality of Korean basic data from various compiled institutions
- Lack of definition and coverage of production factors  
e. g. Total use of water, Wastewater, CO<sub>2</sub>-emissions in breakdown by industries, Hours worked



- Actual state of work

It is sufficient Korean data to provide for analysis on general eco-efficiency and general economic comparison Korea and Germany. But we need more discussions for analysis on comparison of economic structure and environment;

- Data quality regarding breakdown by industries
- Data compilation of environmental production factors on sources
- Interpretation of main results of the analysis



### 3. Further steps regarding co-operation

NSO of Korea suggests

- to finish termination of project(time schedule) excluding publication by the end of this year.
- will be published in the house journals of the statistical offices in English



# **ENVIRONMENT**

## **Environmental-Economic Accounting in Germany 2001**

Results of the Federal Statistical Office presented on the press conference in Frankfurt am Main in October 2001

### **Content**

- 1      The productivity of using nature
- 2      Water and waste water
- 3      Emissions of carbon dioxide
- 4      Tables

Authors: Dr. Karl Schoer, Christine Flachmann, Angela Heinze, Dieter Schäfer, Dr. Bernd Waldmüller

**August 2002**

## 1 The productivity of using nature

Any economic activity, be it the production of goods and services, be it consumption, involves using our natural environment. There are many ways of using nature. Materials are withdrawn from nature as raw materials, areas are used as a location for economic activities, and for the discharge of residuals nature is used as a sink, i.e. substances are taken up by nature.<sup>1</sup>

Doing business in line with the principle of sustainability requires dealing with nature as carefully as possible, so that future generations, too, may enjoy an intact environment. The use of the environment as a source of resources may be measured through the quantities of natural **input factors** such as the consumption of raw materials and energy, as well as the kind and intensity of land use. The use of nature as a sink for residuals can be measured only indirectly, that is through the quantities of residuals discharged. If we establish a relation between the various quantities measured in physical units and the economic performance, we may calculate productivities – similar to studying the economic input factors of labour and capital – as an indicator of the efficiency of using natural input factors. The quantity and productivity trends for the individual environmental input factors however show only whether, and to what extent, the relevant factor is used more carefully than in the past.

### Input factors

For the use of the following input factors in the production process, quantitative trends and productivities can be shown (Table 2):

#### The use of economic factors

- |                |  |
|----------------|--|
| <b>Labour</b>  | - Volume of labour as the total of hours worked (bn hours)                 |
| <b>Capital</b> | - Capital use as consumption of fixed capital<br>(DM bn at prices of 1995) |

#### Nature as a source of resources

- |                         |   |
|-------------------------|---|
| <b>Area</b>             | - Area used as built-up and traffic area (km <sup>2</sup> )   |
| <b>Energy</b>           | - Energy consumption as the consumption of primary energy (petajoules)  |
| <b>Raw materials</b>    | - Raw material consumption, here measured as the quantities of used abiotic raw materials withdrawn from domestic nature and plus imported abiotic goods (mn t) |
| <b>Water withdrawal</b> | - Water consumption as the withdrawal of water from nature (mn m <sup>3</sup> )   |

#### Nature as a sink for residuals

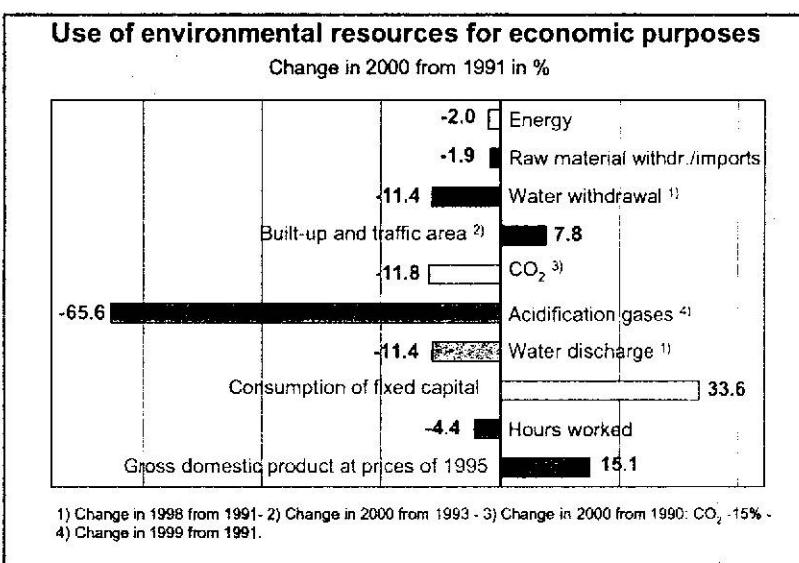
- |                            |   |
|----------------------------|---|
| <b>Greenhouse gases</b>    | - Pressure on the environment through the emission of greenhouse gases, here: carbon dioxide, methane, dinitrogen monoxide (laughing gas) |
| <b>Acidification gases</b> | - Pressure on the environment through the emission of acidification gases, here: sulphur dioxide, nitrogen oxides                         |
| <b>Water discharge</b>     | - Pressure on the environment through the discharge of used water into nature   |

The goal of Environmental-Economic Accounting is to describe the interactions between the economy and the environment. The starting point is national accounts, which – through Environmental-Economic Accounting – are supplemented by the representation of items that are relevant for the environment. Therefore, in addition to the economic production factors of labour and capital, Environmental-Economic Accounting takes account of the production factor of nature and, consequently, the performance of nature used by the economic system. This includes not only the natural inputs with material character (e.g. raw materials), where nature is used as a source of resources, but also the "services" provided by nature, such as the absorption of residuals. Currently it is not possible to directly measure the input of natural services either in monetary or in physical units. This is why such input is measured indirectly through the quantity of residuals taken up by nature. The relation used here (i.e. that between gross domestic product and the quantity of residuals) thus is what nature contributes to production by absorbing those substances (function as a sink). This ensures that the productivity studies include important aspects of the use of nature which have an impact on changes in the quality of the ecosystems or on climat changes.

Providing information on the extent to which sustainability has been achieved is possible through the indicators only when applying specific sustainability targets.

In Germany, the quantitative use of most natural factors decreased in the 1990s, although the extent differed considerably. **Nature as a source of resources**, in its function as a raw material and energy provider, was somewhat less heavily used in 2000 than in 1991 (figures 1 and 2). Raw material consumption was down 1.9%, energy consumption 2.0%. If we consider the impact of weather-related fluctuations, however, energy consumption was presumably rather stagnant over the period examined, because average temperatures in 2000 were higher than in the base year 1991. Thus at least part of the decrease in energy consumption shown for that period was due to the more favourable weather in the last year of the period. Another factor influencing the trend of energy consumption was the marked decrease of energy use in the new Länder in the early 1990s. The trend of raw material consumption was mainly influenced by fluctuations in demand for construction raw materials.

Figure 1

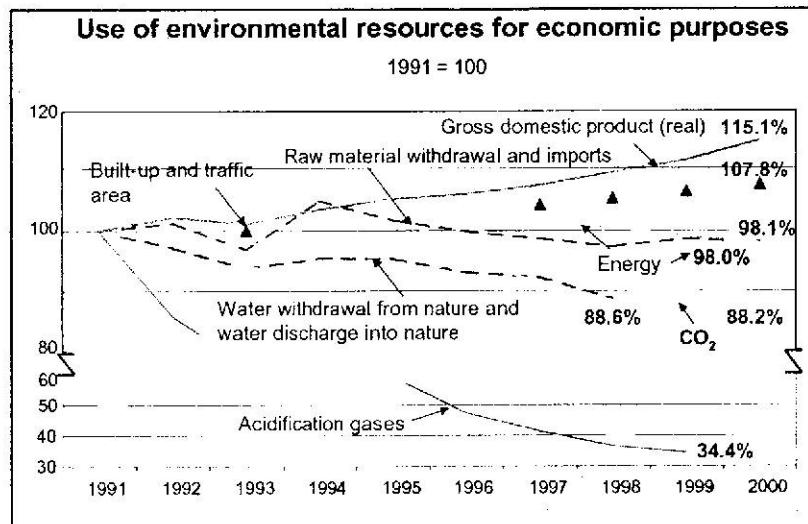


The decrease in the withdrawal of water from nature (-11.4%) between 1991 and 1998 was much larger than that of energy and raw material consumption. The trend of waste water discharge was the same as that of water withdrawal. The decline in water consumption was due in particular to changes of water-relevant legal provisions and a sharp rise in water and waste water charges.

According to provisional estimates of the Federal Office for Building and Regional Planning for 2000, built-up and traffic area increased from 40 305 km<sup>2</sup> in 1993 to 43 447 km<sup>2</sup> in 2000 (+ 7.8%). That was an increase by 123 ha per day over that period. In 2000, the increase was slightly larger (129 ha per day) than over the entire period.<sup>2</sup> Regarding the development of land use, the Federal Ministry for the Environment has set targets for the Environmental Barometer. According to those targets, land use should be reduced from 120 ha per day in the period from 1993 to 1997 to 30 ha per day by 2020. Considering the above increase in the late 1990s, to achieve that goal, a marked inversion of trend would be required which, however, is not in sight yet.

The use of **nature as a sink** for residuals in the context of air emissions has clearly decreased since the early 1990s. The discharge of acidification gases was down 65.6% between 1991 and 1999, reaching a third of the original level. The strong decrease in acidification gas emissions is mainly due to flue gas desulphurisation.

Figure 2

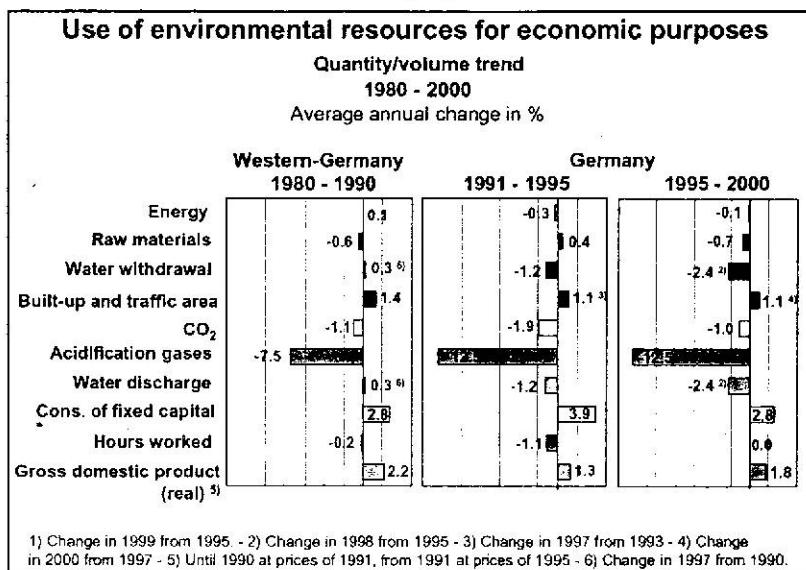


For CO<sub>2</sub> discharge, too, a positive trend was recorded. When put in relation to 1991 – which for reasons of data availability is generally used as a reference year in this report –, CO<sub>2</sub> emissions decreased by 11.8%. As is the case for energy consumption, the decrease in CO<sub>2</sub> emissions, too, is overshadowed by the temperature effect contained in the original figures. The development of carbon dioxide emissions, which is better than the trend of energy consumption, is mainly due to an increased use of energy sources containing less carbon. The use of energy sources containing much carbon, such as hard coal and brown coal, was down 30% and 41% from 1991 to 1999, respectively. Correspondingly, the quantity of natural gas used, which contains less carbon, was up 26% and nuclear energy, which does not produce CO<sub>2</sub> emissions, grew 34%.

Compared with 1990 (the reference year for the Federal Government's goal of reducing the emission of carbon dioxide), the discharge of carbon dioxide (CO<sub>2</sub>) was down 15%. The Federal Government aims at a 25% reduction for the period from 1990 to 2005. Actual CO<sub>2</sub> emissions fell by 153 mn t to 861 mn t between 1990 and 2000<sup>3</sup>. This is an average annual decrease by 15 mn t or 1.6%. More than half of the overall reduction of CO<sub>2</sub> emissions between 1990 and 2000, that is 86 mn t, was achieved between 1990 and 1992. So for the period starting in 1992, the average decrease (8.3 mn t or 0.9% per year) was markedly smaller than for the entire period. To meet the Federal Government's target (reduction to 760 mn t by 2005), CO<sub>2</sub> emissions into the environment in Germany would have to fall an annual 20.2 mn t or 2.4% on average in the years remaining until 2005. With the national climate protection programme adopted in autumn 2000, the Federal Government started additional measures to reduce CO<sub>2</sub> emissions.

When adjusted for price changes, the gross domestic product – measuring economic performance – rose 15.1% in the examined period from 1991 to 2000. The trend in the use of nature caused by such economic growth thus was comparatively moderate. The amount of capital employed – measured through the consumption of fixed capital – rose by just under 34%. That strong increase in capital utilisation and the related technological progress led not only to a reduction in the use of nature but also to a decrease in the input factor of labour, in spite of the growing domestic product. Between 1991 and 2000, the number of hours worked fell 4.4%. Although, compared with the smaller utilisation of the labour factor, the decrease in the use of the environment through the withdrawal of water and emissions of carbon dioxide and acidification gases was larger, the trends for the factors of energy, raw materials and built-up and traffic area were clearly less marked than the savings regarding hours worked.

Figure 3



A long-term examination of the development of the input of natural factors shows that, although the use of such factors increased between 1960 and 1980, it decreased again in the 1980s and 1990s – with the exception of built-up and traffic area (cf. Report on Environmental-Economic Accounting for the press conference in 2000). However, examining the 1980s and 1990s more in detail does not reveal really uniform trends (figure 3).

Uniform trends are observed for the growth of built-up and traffic area and for the reduction of CO<sub>2</sub> and acidification gas emissions for western Germany in the 1980s and for Germany in the first and the second half of the 1990s. The use of area for built-up and traffic area in the former territory of the Federal Republic rose an average 1.4% per year in the 1980s. Both in the period from 1993 to 1997 and from 1997 to 2000, the average annual increase for Germany (+1.1% each) was somewhat smaller. Both for the CO<sub>2</sub> emissions and the acidification gas emissions, the average annual reduction in the 1990s was larger than in the 1980s.

For the other natural factors, the trends of utilisation in the three periods examined (1980s, first half and second half of the 1990s) differed. For energy consumption, the differences between the 1980s and the 1990s were rather small. In the 1980s, a small rise by an average 0.1% per year was observed for western Germany. In Germany, the average decrease in the first half of the 1990s (-0.3%) was somewhat larger than in the second half (-0.1%). The use of raw materials grew an average 0.4% per year in the first half of the 1990s, one

#### Productivity – An indicator of the efficiency of factor use

The productivity of an input factor indicates how much economic output is produced by using one unit of the factor concerned.

$$\text{Productivity} = \frac{\text{Gross domestic product (real)}}{\text{Input factor}}$$

Productivity indicates how efficiently a national economy deals with the use of labour, capital and nature. Due to their different qualities and functions, those factors cannot directly be compared with each other. However, by observing their development over long periods one may obtain information on how the relations between the factors have changed.

It must also be noted that for the calculation of productivities the entire real yield of the economic activity is referred only to the production factor concerned, although the product is created through the joint action of all production factors. Therefore productivities as calculated can serve only for rough orientation.

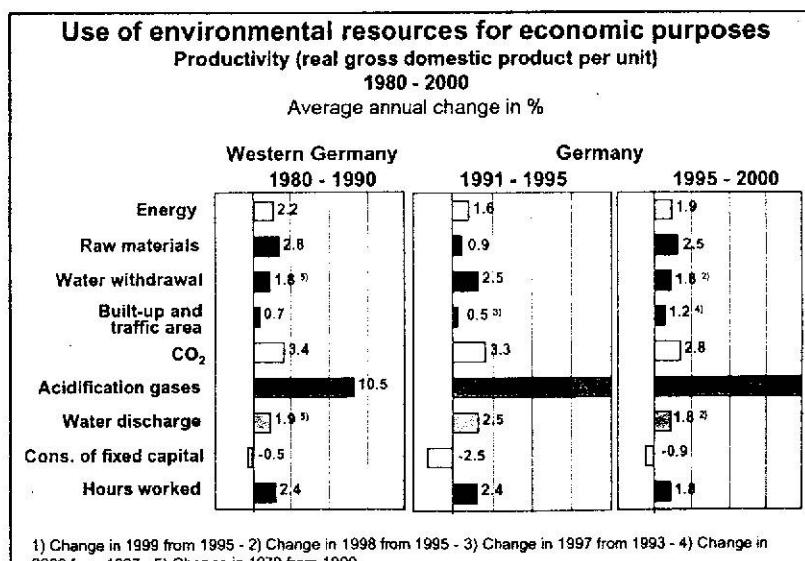
reason being the construction boom in the new Länder at the time. The decrease in the second half of the 1990s (-0.7% per year), however, was larger than in western Germany in the 1980s (-0.6%). Both for water withdrawal from nature and for the quantity of water discharge, the decrease in the second half of the 1990s (-2.4% per year) was markedly larger than in the first half of the 1990s (-1.2%). In the 1980s, a slight increase was recorded for both items (+0.3%). Altogether, for most of the production factors examined, the quantities used – showing the extent of environmental burdens – fell in the second half of the 1990s; in some cases, the decrease was much stronger than in the western Germany in the 1980s. Only the use of areas still shows rather stable growth rates at a high level.

However, the utilisation of natural input factors caused by the economic development differed between the three comparative periods. In the period from 1980 to 1990, the annual average growth of the price-adjusted gross domestic product in western Germany (+2.2%) was considerably larger than in Germany in the 1990s (+1.3% from 1991 to 1995 and +1.8% from 1995 to 2000).

From the aspect of the efficiency of using natural input factors, the result thus differs from what was obtained when examining absolute quantities. The **efficiency** in using natural input factors – measured as the productivity, i.e. economic performance (real gross domestic product) per unit of an input factor – increased in the 1980s and 1990s for all factors examined, however to differing degrees (figure 4). Especially when comparing the second half of the 1990s with the 1980s, an examination of efficiency shows other results than an examination of absolute quantities used. Such absolute quantities in the second half of the 1990s showed larger decreases and smaller increases in Germany than in the 1980s (see figure 3), whereas a study of productivities provides a varied picture: For built-up and traffic area and for acidification gases, the average annual increases in productivity in the second half of the 1990s were larger than in the 1980s (built-up and traffic area 1.2% versus 0.7%, acidification gases 16% versus 10.5%). For the factors energy, raw materials and carbon dioxide, however, lower productivity growth rates were recorded than in the 1980s. For all natural input factors, with the exception of built-up and traffic area, the growth in productivity in the second half of the 1990s, however, was at least at the same level (water) as the increase in labour productivity (1.8%) or above that rate.

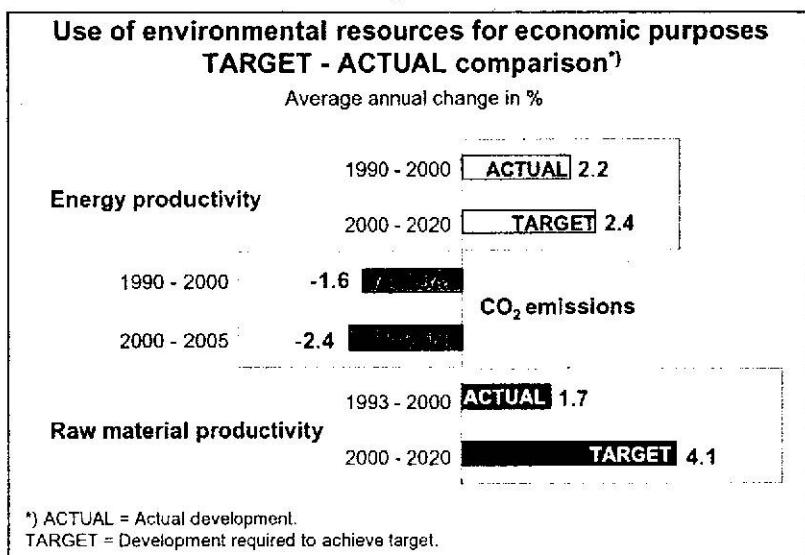
With regard to the development of energy and raw material productivity, the Federal Ministry for the Environment has set **targets** in the context of the Environmental Barometer. Energy productivity should double between 1990 and 2020. Between 1990 and 2000 it rose by

Figure 4



about 24%. This corresponds to an annual average growth of 2.2% (figure 5). To meet the target set by the Federal Ministry for the Environment, an average annual increase by 2.4% would be required for the remaining years until 2020. For raw material productivity, a 2.5-fold increase on the level of 1993 is envisaged for 2020. It rose 12.3% between 1993 and 2000, which is an annual average increase of 1.7%. To meet the target set by the Federal Ministry for the Environment for the increase in raw material productivity until 2020, an average annual increase of raw material productivity by 4.1% would be required in the years after 2000. This means that for both productivity indicators a much faster development is required to meet the targets. Although the comparison between the first and the second half of the 1990s shows clear tendencies towards a faster development, the level of productivity development required to meet the political targets was not reached in that period.

Figure 5



<sup>1</sup> In addition to its function as a sink, other services provided by nature should be mentioned such as the buffer, recreation and production functions.

<sup>2</sup> The impairments of nature and landscape caused by the use of area for built-up land and land used for traffic purposes can in part be compensated for by compensation or replacement measures (Articles 8, 8a Federal Law on Nature Conservation); it is not possible yet to provide quantitative information on that issue.

<sup>3</sup> Data source: Federal Environmental Agency.

## 2 Water and waste water

The principle of **sustainable water management** is an element of Agenda 21, adopted at the Environment Conference in Rio de Janeiro in June 1992. There, it is considered necessary to protect water as a natural resource and to deal with it in a manner that is compatible with nature, efficient in economic terms and fair from social aspects. Also, the new EU framework Directive on water (Directive 2000/60/EC) creates a uniform frame for water protection and shows criteria for the assessment and preservation of water resources, thus contributing to sustainable use of water.

### Water flow accounts

Various data sources are used for the water flow accounts forming part of Environmental-Economic Accounting (UGR). Most of the basic data are taken from official statistics (statistics on water supply and waste water disposal in mining and manufacturing and in thermal-electric power plants for public supply as well as statistics of public water supply and waste water disposal). To bridge data gaps, other data (e.g. on agriculture) from publications of official statistics and of scientific institutes and organisations are used.

The goal of UGR is to show water flows in a breakdown by homogeneous branches and industries - from water withdrawal from nature to its passing into the economic system and the discharge of water into the natural system - and to draw up a complete balance of all water and waste water flows that are relevant for the economic process. This report shows the results by industries (national classification of economic activities, WZ 1993).

The water withdrawn from nature is used for various economic activities, including production processes of businesses and consumption of households. In the economic process, water is distributed, incorporated in or removed from products, and it can be exported or imported. Water is discharged into nature in the form of waste water or evaporation.

From environmental aspects, the withdrawal of water from nature and the discharge of waste water into nature is relevant in more than one respect.

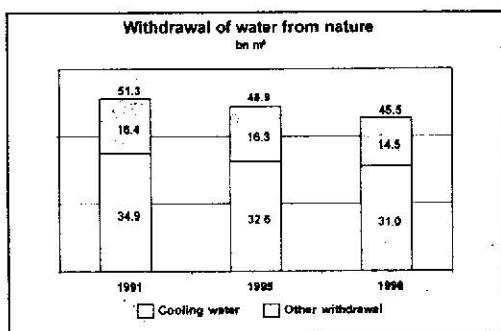
Withdrawing water from nature may pose a problem even if the amount withdrawn is far below the threshold of the regeneration rate of the natural water supply. This is because water withdrawal always interferes with natural processes and, consequently, has an impact on the natural systems such as ecosystems or groundwater systems. The environmental quality may be heavily impaired by waste water. Most of the water withdrawn is returned to nature in the form of waste water, i.e. in a different condition and generally at a different location. Relevant aspects of the discharged water are its quantity and, in particular, its quality.

The results presented here have been taken from water flow accounts forming part of Environmental-Economic Accounting. Major data sources for calculation are environmental statistics. The goal of water flow accounts is to represent water and waste water flows caused by economic activities. For the time being, the report focuses on the quantitative representation of water flows at the national level, broken down by types of water and waste water. It is intended to supplement those data by additional information in the future. A working group of the statistical offices of the Länder has started setting up a regional presentation of such accounts. As part of Environmental-Economic Accounting, the Federal Statistical Office is developing a procedure to determine the pollutant loads in waste water.

### Withdrawal of water

In 1998, a total of 45.5 bn m<sup>3</sup> of water were withdrawn from nature for economic purposes in Germany (figure 6). Comparisons are made between **water withdrawal** and the total **water resources available** in Germany which, on a long-term average, are estimated at 182 bn m<sup>3</sup> per year. Two thirds of the total amount (45.5 bn m<sup>3</sup>) of water withdrawn from nature in 1998 were used as cooling water. In the 1990s, water withdrawal from nature decreased considerably. Between 1991 and 1998, it decreased 11.4% (5.8 bn m<sup>3</sup>). Withdrawal of cooling water was down 11.1% (3.9 bn m<sup>3</sup>).

Figure 6



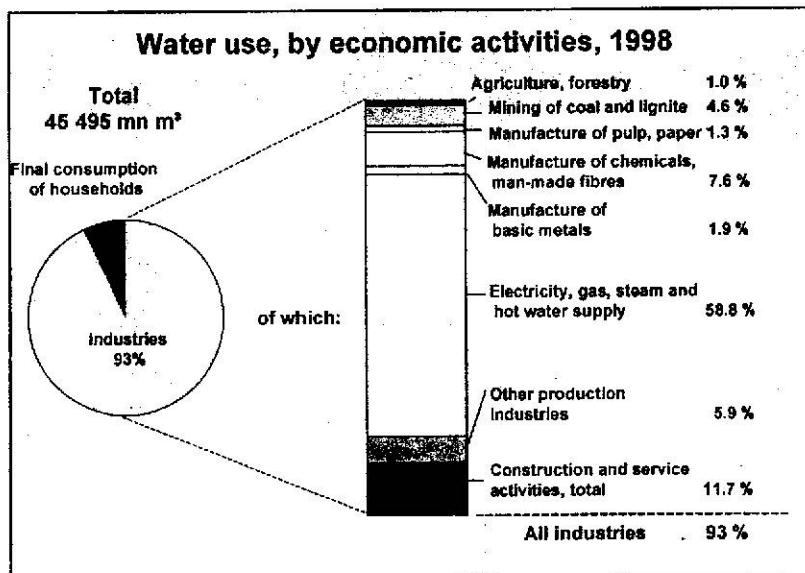
The decrease in water withdrawal from nature was accompanied by a growth in economic performance (+9.7%), measured as the trend of the real gross domestic product in 1998 compared with 1991. This means that water was used more and more efficiently. More efficient use of the resource of water was supported especially by the trend of water and waste water prices, and by relevant new technologies such as household appliances and production procedures requiring less water. Producer prices

of water to be distributed to households and the industry rose by just under 50% between 1991 and 1998. That increase was clearly larger than the increase in total producer prices (+3.2%) over the same period.

**Water use in the individual industries** (production) and for household consumption showed quite different trends. Water use in the industries and in households is composed of the water withdrawn by the relevant sector itself plus water received from other sectors, minus water transferred to other units. According to the concept of Environmental-Economic Accounting, the entire water use also includes foreign water and rainwater, water losses and water discharged without having been utilised. At the macroeconomic level, the volume of water used differs from the quantity of water withdrawn from nature only by the balance of water exports and imports (water flows across the borders of Germany).

Out of the total volume of water used (45.5 bn m³), production accounted for 93% and households for 7% in 1998 (figure 7). Far more than half of the water used within Germany was used in the economic sector of "electricity, gas, steam and hot water supply" (59%), where it was used almost only as cooling water. Other sectors that had large shares in the total volume of water used were "manufacture of chemicals, chemical products and man-made fibres" (8%), "mining of coal and lignite" (5%), "manufacture of basic metals" (2%),

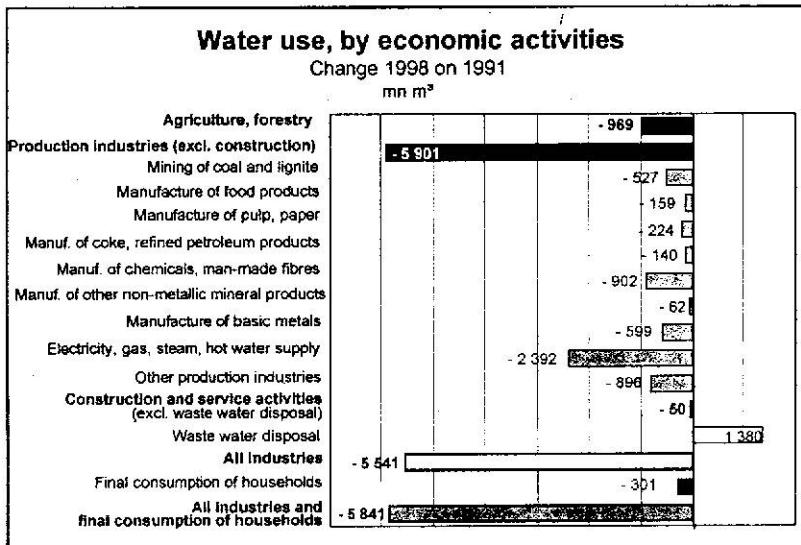
Figure 7



"manufacture of pulp, paper and paper products" (1%) and "agriculture, forestry" (1%). Nearly all the water used in "mining of coal and lignite" was mine water discharged without being used, while in "agriculture, forestry" the main part was irrigation water.

Except for "waste water disposal", all important industries showed a declining volume of water used (figure 8). The most marked decreases were recorded for the sectors "electricity, gas, steam and hot water supply" (2.4 bn m<sup>3</sup> or -8.2%), "agriculture, forestry" (969 mn m<sup>3</sup> or -67.5%), "manufacture of chemicals, chemical products and man-made fibres" (902 mn m<sup>3</sup> or -20.7%) and "manufacture of basic metals" (599 mn m<sup>3</sup> or -40.9%).

Figure 8

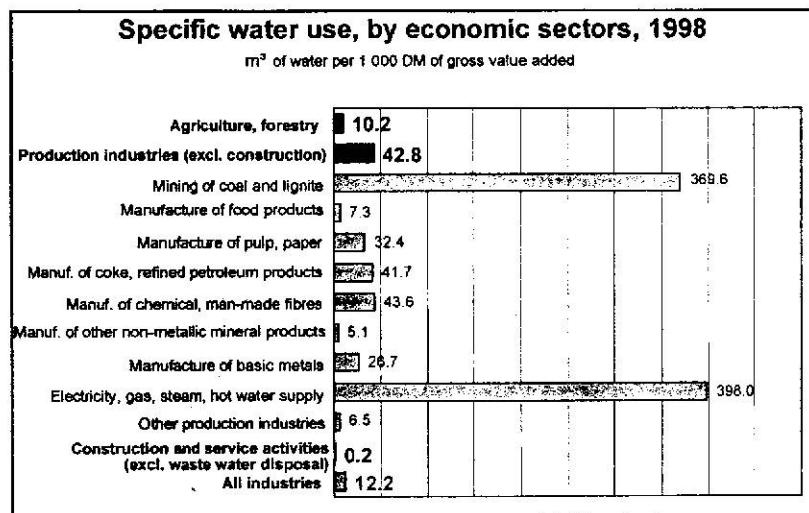


The increase in water consumption in the sector of "waste water disposal" (+1.4 bn m<sup>3</sup>) was due to the marked rise in the quantity of foreign water and rainwater, which is allocated to that sector. The reasons for an increase in the amount of foreign water and rainwater are the extension and restoration of the sewage network. The rather strong decline in the volume of water used in "agriculture, forestry" to about a third of the original level was due mainly to the fact that 1998 was a rainy year and that the use of irrigation water in the new Länder was reduced again.

The reasons for the reduction of water use in production industries included factors within businesses. In particular, the multiple and circulatory use of water increased. The ratio between the total quantity of water used and the quantity of water used in businesses rose from just over 4:1 in 1991 to nearly 5:1 in 1998. Especially in the industries of "manufacture of chemicals, chemical products and man-made fibres", "manufacture of basic metals" and "mining of coal and lignite", employing low water consumption technologies and substituting water by other substances such as emulsions play a major part.

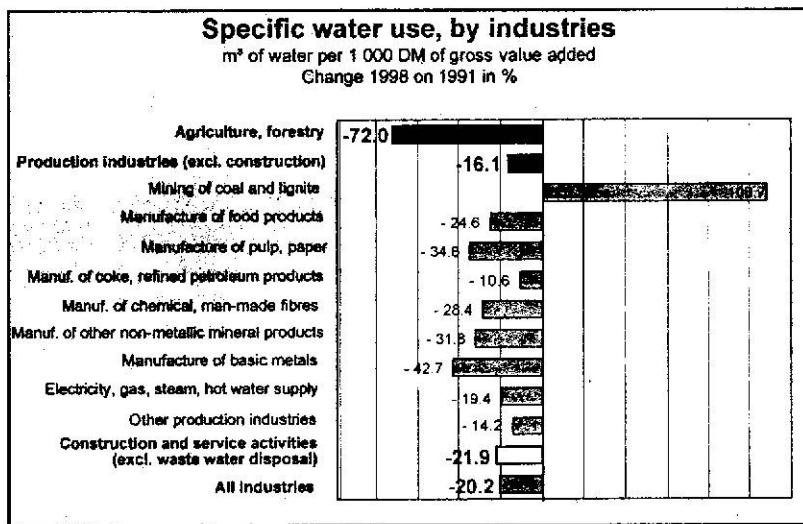
The level of **specific water use** - measured as water use per gross value added - differs between the industries because of the technological situation and the resulting amount of water required (figure 9). On an average of all industries, 12.2 m<sup>3</sup> of water per DM 1 000 of gross value added were used in 1998. In total production industries (excl. construction), specific water use amounted to 42.8 m<sup>3</sup> per DM 1 000. Specific water use is especially high in the sectors of "mining of coal and lignite" (369.6 m<sup>3</sup> of water per DM 1 000 of gross value added) and of "electricity, gas, steam and hot water supply" (398 m<sup>3</sup> per DM 1 000 of gross value added). In "manufacture of chemicals, chemical products and man-made fibres", specific water use amounts to 43.6 m<sup>3</sup> per DM 1 000, in "manufacture of coke, refined petroleum products" to 41.7 m<sup>3</sup> per DM 1 000, and in "manufacture of pulp, paper and paper products" to 32.4 m<sup>3</sup> per DM 1 000 of gross value added.

Figure 9



In the past decade, water was used more and more efficiently. In the industries represented (with the exception of "mining of coal and lignite"), the specific water use decreased from 1991 to 1998. In production industries, specific water use was down 16.1%, while in construction and service activities together it was down 21.9%. Within production industries, the trend of specific water use was -42.7% in "manufacture of basic metals", -34.6% in "manufacture of pulp, paper and paper products", and -31.8% in "manufacture of other non-metallic mineral products" (figure 10).

Figure 10

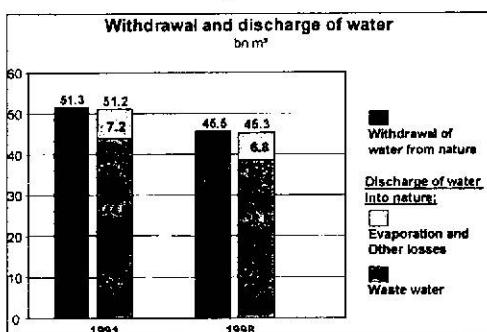


In "mining of coal and lignite", however, specific water use was up by 108.7%. The main reason here is a fall in value added due to smaller amounts of material extracted, without this trend having resulted in a similar decrease of water use. It should be noted here that the amount of mining water depends mainly on geological factors.

### Waste water

The level and trend of the amount of waste water depend on the amount of water withdrawn from nature. The difference between the two figures is basically the item "evaporation and other losses" (figure 11). In 1998, a total of 38.6 bn m<sup>3</sup> of waste water was discharged into nature. As is the case for water withdrawal, the main part of waste water is cooling water. The share of cooling water in 1998 was 79% (30.6 bn m<sup>3</sup>). This referred almost entirely to cooling water from power production processes. The temperature of cooling water discharged is higher than that of water withdrawn, so that it puts pressure on the environment. Also, due to the procedures applied, it may contain chemical substances that are used to protect the cooling systems from being covered by algae and that also put pressure on the environment. Most of the water discharged without prior treatment is mine water, which generally is not polluted.

Figure 11



### Waste water treatment

During mechanical treatment, coarse elements and depositable substances are separated through screens, sand traps as well as sedimentation and preclarifier basins. Generally, however, mechanical treatment is not sufficient to clarify heavily polluted waste water. Therefore, biological procedures have to be applied in addition. This involves the removal of biodegradable substances by microorganisms. During the more intensive chemical waste water treatment, other pollutants such as phosphorus compounds are removed through chemical and chemical-physical processes.

Parallel to the decrease in water withdrawal, waste water discharge too declined in the 1990s. Just under 6.0 bn m<sup>3</sup> were treated waste water and 2.0 bn m<sup>3</sup> were other untreated waste water (figure 12). The volume of waste water fell by 12.3% (-5.4 bn m<sup>3</sup>) between 1991 and 1998 (figure 13). Above-average decreases were recorded for the discharged quantities of treated (-16.8%) and untreated waste water (-15.7%). The volume of discharged cooling water was down 11.1%.

Figure 12

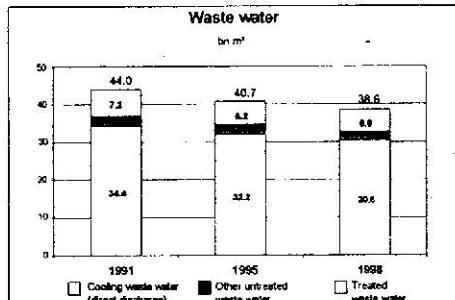
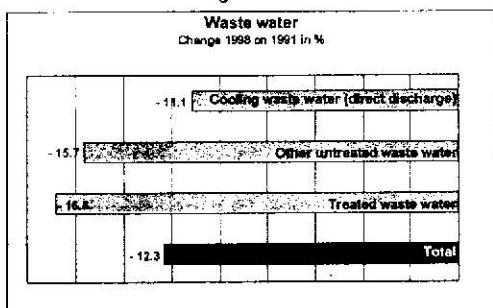


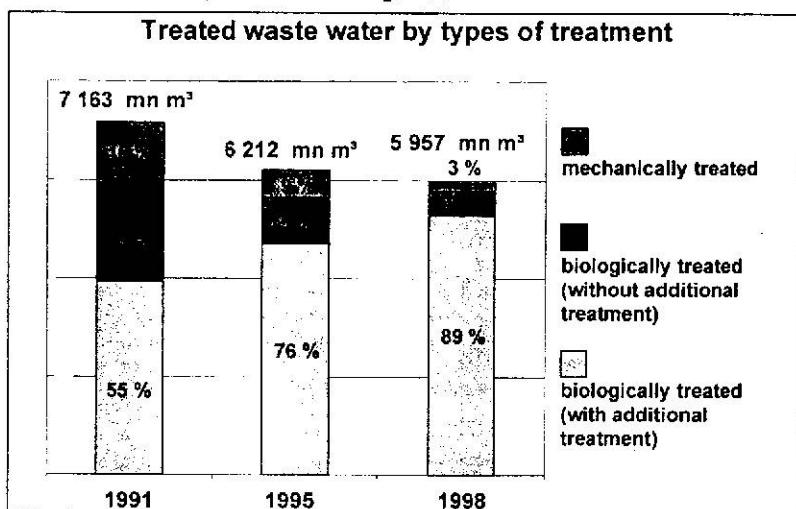
Figure 13



Waste water is discharged – indirectly – through the public sewage system (with or without prior treatment in the businesses' own purification plants) or directly back into nature. There are economic factors exerting influence on how waste water is discharged, e.g. the costs of a business's own purification plant as compared to the costs of an external plant, and legal provisions such as limiting values for pollutants.

The quality of the treatment of waste water improved considerably since the early 1990s. The share of biological procedures with additional treatment in the total volume of treated waste water rose from 55% in 1991 to 89% in 1998, while the share of waste water treated only mechanically was down from 16% to 3% (figure 14).

Figure 14



Treating waste water involves considerable **financial costs**, which generally are borne by those who caused the pollution; for instance, in public waste water disposal this is achieved through charges. According to the results of Environmental-Economic Accounting, expenditures to the amount of DM 32.5 bn were made on waste water treatment in 1997 by production industries, general government and the privatised public enterprises working on sewage and refuse disposal; about half of that amount was spent on investments, the other half on the current operation of the water protection plants. This means that the amount spent on waste water treatment was nearly the same as that spent on waste disposal, air quality control and noise abatement together. The value of fixed assets formed over the years for water protection is considerable, too: At the beginning of 1998 that value was DM 377 bn, which is 78% of the total fixed assets for environmental protection and about 2% of fixed assets of the overall economy. Compared with 1991, the value of fixed assets for water protection, measured in prices of 1995, rose by DM 55.5 bn or 17%.

#### Water withdrawal in a European comparison

The availability and the utilisation of water in **European countries** are subject to different geological and climatic conditions. The countries in the southern part of the European Union withdraw large quantities of water for irrigation in agriculture, while Central European countries need water mainly for industrial purposes, e.g. cooling water in power production.

#### Withdrawal of water in European Union countries

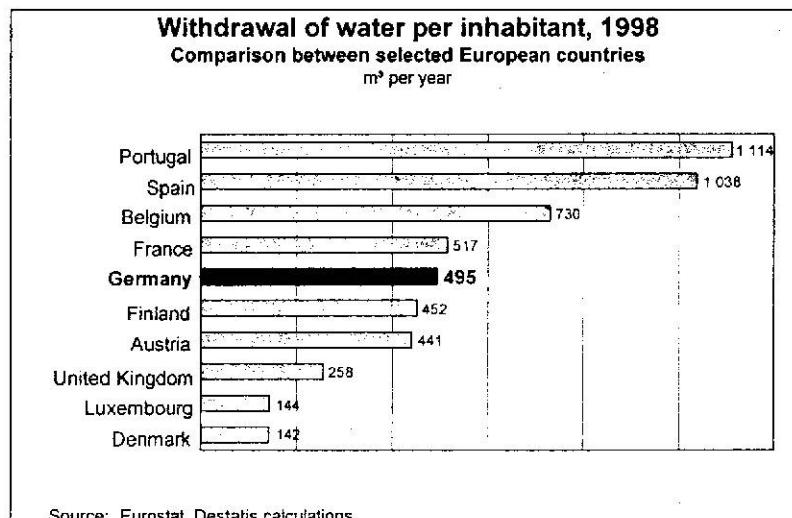
Regarding the statistical data from European Union countries, it should be noted that not all of them are based on the same methodological concepts. Although sea and brackish water have not been included in water withdrawal here, they may be quite important in some countries. In many cases, the data on the withdrawal of water in agriculture refer only to irrigation water, while not taking account of water required for animals. The coverage of cooling water does not always include cooling water used for power generation and for industrial processes.

A comparison of water withdrawal between selected European countries from macroeconomic aspects shows that in 1998 Germany ranked in the middle as regards **water withdrawal per inhabitant and year** (495 m<sup>3</sup> per inhabitant and year) (figure 15). However, the

international data cannot fully be compared with the above results of Environmental-Economic Accounting, especially because the data available do not include the withdrawal of foreign water and rainwater.

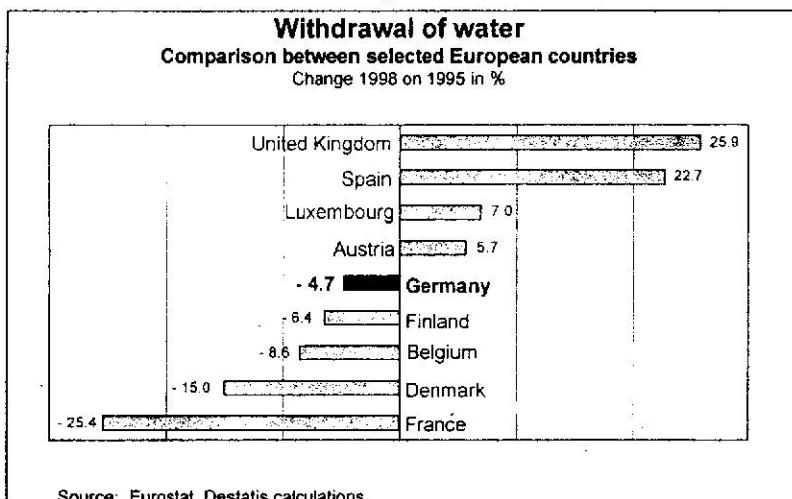
Portugal ranked first in water withdrawal ( $1\,114 \text{ m}^3$  of water withdrawn per inhabitant and year), followed by Spain ( $1\,038 \text{ m}^3$ ), Belgium ( $730 \text{ m}^3$ ) and France ( $517 \text{ m}^3$ ) (figure 10). In some countries, water withdrawal per inhabitant was lower than in Germany. They include Finland ( $452 \text{ m}^3$ ), Austria ( $441 \text{ m}^3$ ), the United Kingdom ( $258 \text{ m}^3$ ), Luxembourg ( $144 \text{ m}^3$ ) and Denmark ( $142 \text{ m}^3$ ).

Figure 15



As regards the trend of water withdrawal, Germany also ranked in the middle of the European countries for the examined period from 1995 to 1998. In that period, water withdrawal in Germany fell 4.7% (figure 16). The reduction was much more pronounced in France (-25.4%), followed by Denmark (-15.0%), Belgium (-8.6%) and Finland (-6.4%). Water withdrawal rose, however, in the United Kingdom (+25.8%), Spain (+22.7%), Luxembourg (+7.0%) and Austria (+5.7%).

Figure 16



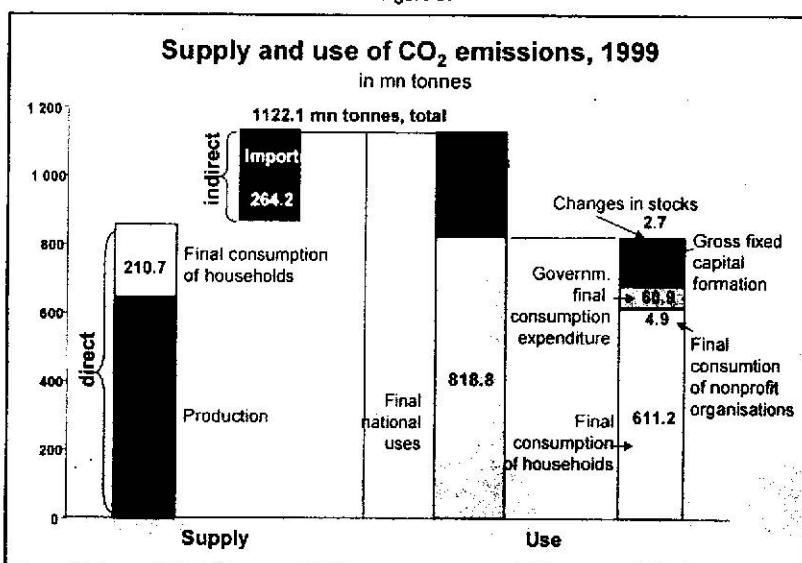
### 3 Emissions of carbon dioxide

#### Overall economy

Emissions of carbon dioxide ( $\text{CO}_2$ ) are mainly created by the burning of fossile energy sources such as coal, mineral oil and natural gas. Such emissions are a major cause of global warming, as has repeatedly been stated by the Intergovernmental Panel on Climate Change (IPCC)<sup>1</sup>.

Energy consumption and the consequent  $\text{CO}_2$  emissions can be examined both from the production aspect and the use aspect, in analogy to the representation of income and value added aggregates in national accounting. This is because  $\text{CO}_2$  emissions are produced on the one hand during the production of goods and in part directly through the consumption activities of households (e.g. room heating or individual transport) and, on the other hand, they are caused through the final demand for goods. The **uses side** (figure 17) of  $\text{CO}_2$  emissions consists of exports (303.2 mn t) and national uses (818.8 mn t). Major items of the latter are emissions caused by the consumption of goods by households (611.2 mn t), the consumption of goods by general government (60.9 mn t) and fixed capital formation (139.2 mn t).

Figure 17



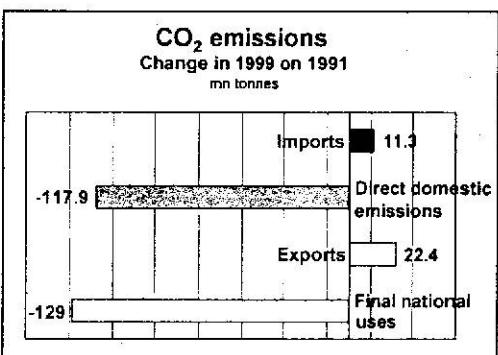
The **supply side** shows direct emissions, broken down by the activities of production and consumption by households, and emissions caused by the production of imported goods in the rest of the world (indirect emissions). Direct emission of carbon dioxide in Germany caused by economic activities amounted to 857.9 mn t in 1999. Of that amount, 647.2 mn t (75%) were emitted during the production of goods and services and 210.7 mn t (25%) were produced directly through household consumption activities.

#### Calculating direct emissions into the air

Direct emissions of the various air pollutants are calculated for industries and households by means of specific emission coefficients (database of the Federal Environmental Agency), energy consumption (database of the German Institute for Economic Research / energy balance) and by taking account of the processes running in the branches.

Between 1990 and 2000, CO<sub>2</sub> emissions decreased by 153 mn t. In the following, the causes of that trend are analysed on the basis of Environmental-Economic Accounting in a detailed breakdown by economic activities. Data for such a detailed analysis are available for the period from 1991 to 1999. For overall analyses of the emission trend, the year 1990 is suited as a reference year, while for structural analyses, the year 1991 should be preferred.

Grafik 18



Between 1991 and 1999, direct CO<sub>2</sub> emissions (production and consumption) decreased by 117.9 mn t (-12.1%) to 857.9 mn t. Direct carbon dioxide emissions of households (consumption) were down by 8.5 mn t (-3.9%) over the period examined (figure 18). Direct emissions in domestic production declined by 109.4 mn t (-14.5%). The decrease thus was much more marked here than that observed for household consumption.

About two thirds of the emissions produced directly through consumption by **households** in 1999 regarded the purpose of "energy" (private heating of buildings, hot water preparation, cooking), while one third was due to the utilisation of motor fuels for private transport. The 3.9% decrease in direct CO<sub>2</sub> emissions by households was contrasted by a rise in price-adjusted final consumption expenditure by 11.2% (see table 4). Over the same period, direct energy consumption of households rose 12.2%, that is even slightly more than final consumption expenditure. This means that the decoupling of the trends of final consumption expenditure of households and of their direct CO<sub>2</sub> emissions is entirely due to the utilisation of energy sources containing less carbon. In particular, households replaced hard and brown coal by natural gas, which contains less carbon. Between 1991 and 1999, the use of natural gas by households rose 49.3%, while the use of hard coal and brown coal was down 56.5%.

The development of direct CO<sub>2</sub> emissions in **production** (industries) is determined mainly by the level of production. With other conditions remaining constant, CO<sub>2</sub> emissions would increase or decrease along with the development of production. Decreases in emissions along with rising production may be achieved if the energy, whose use causes the emission of CO<sub>2</sub>, is used more efficiently, i.e. if businesses succeed in producing the same product while using less energy. That process is supported both by general technological progress and by the relative rise of prices of the production factor of energy.

#### Hypothetical CO<sub>2</sub> emissions

The following factors influencing the trend of hypothetical CO<sub>2</sub> emissions during production (all industries) between 1991 and 1999 were taken into account:

- economic output (gross value added at prices of 1995)
- economic structure (shares of industries in the gross value added of production)
- energy intensity of the production (total energy consumption / gross value added) and
- CO<sub>2</sub> intensity of energy consumption (CO<sub>2</sub> emissions / total energy consumption).

The results regarding the hypothetical trend of CO<sub>2</sub> emissions are obtained with the assumption that for one factor the value of 1991 is imputed, whereas for the other factors the values of 1999 are assumed. The difference between hypothetical and actual CO<sub>2</sub> emissions may be interpreted as the impact which the factor kept constant has on the reduction of emissions.

Other potential factors that might contribute to reduction are, as for household consumption, the changeover to using energy sources containing less carbon per energy unit - e.g. replacing coal by natural gas or renewable energy sources - and the structural change towards a production structure with a larger share of types of goods whose production requires less energy. Such structural change is mainly the result of changed structures of demand. It consists of a variety of trends, some of which are countervailing with regard to energy consumption.

The impact of the above four components on the overall trend of CO<sub>2</sub> emissions may be estimated with certain assumptions. The influence of increased efficiency and structural change, however, can be shown separately only if data are available with a sufficiently detailed breakdown by industries, as is the case in Environmental-Economic Accounting.

When determining the impact of the individual components, the actual trend of emissions was compared with a hypothetical trend which would have occurred under the assumption that the factor under examination remained constant over time while for the other three factors the actual trend was assumed. The effects thus obtained can however be considered only as a rough orientation for the contribution of the individual factors to the overall development of CO<sub>2</sub> emission. This is because the level of any effect is also influenced by the level of the other three effects and, in strictly mathematical terms, cannot be added up.

Figure 19

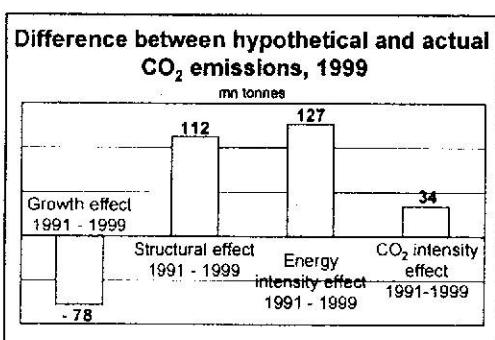


Figure 19 shows, for the period from 1991 to 1999, the difference between the hypothetical and the actual CO<sub>2</sub> emissions. With gross value added remaining the same as in 1991 and other conditions unchanged, CO<sub>2</sub> emission in 1999 would have been smaller by about 78 mn t (growth effect). The other three factors contributed to a decrease of actual CO<sub>2</sub> emissions. Improving the efficiency of energy use in the individual industries reduced CO<sub>2</sub> emissions by an estimated 127 mn t (energy

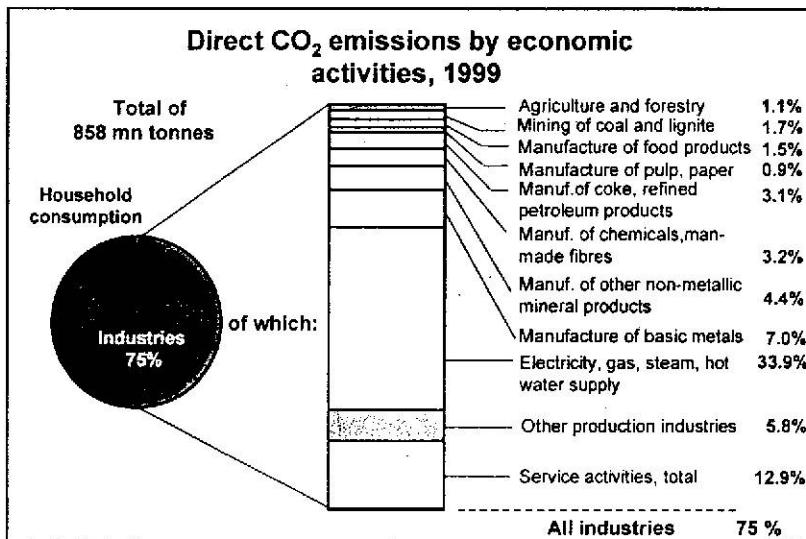
intensity effect). Structural change, i.e. the change in the demand structure of the overall economy towards types of goods that are less energy-intensive (structural effect), accounts for a decrease in emissions by 112 mn t. The increased use of energy sources involving less emission (CO<sub>2</sub> intensity effect) had a comparatively small effect (reduction by 34 mn t).

### Emissions by industries

The distribution of emissions by industries clearly shows some concentration. 75% of total direct emissions in 1999 were caused by the production of goods and services, 25% by household consumption (figure 20). Production industries accounted for about 61% of total emissions. About one third (34%) was caused by "electricity, gas, steam and hot water supply". Most of the CO<sub>2</sub> emissions of that branch are caused by electricity generation. "Manufacture of basic metals" ranked second with 7%, followed by "manufacture of other non-metallic mineral products" (a good 4% of all emissions), and "manufacture of chemicals, chemical products and man-made fibres" (3%). The share of "manufacture of coke, refined petroleum products" was 3%, too. It should be taken into account here that the CO<sub>2</sub> emissions of "electricity, gas, steam and hot water supply" (about 291 mn t) resulted from that industry's primary function, which is the transformation of fossile energy sources into electricity and electricity supply to other industries. The service sector together had a share of just under 13%.

For a realistic assessment of the chances to meet the national target for emissions (reducing the emissions by 25% in 2005 compared with 1990), the trends of CO<sub>2</sub> emissions in the

Figure 20



industries for 1999 compared with 1991 are of particular importance. The "big" producers of CO<sub>2</sub> emissions achieved considerable reductions over the last few years. As mentioned above, of the reduction achieved within Germany (117.9 mn t in 1999 compared with 1991), 109.4 mn t were contributed by the economy (figure 21). For example, "manufacture of other non-metallic mineral products" and "service activities, total", however, caused more emissions in 1999 than in 1991. What had a major impact on total services is the marked increase in CO<sub>2</sub> emissions in "trade", "land transport" and "air transport" (see table 33).

If the CO<sub>2</sub> emissions of industries are put in relation to their gross value added, i.e. if we examine the specific CO<sub>2</sub> emissions, the following picture is obtained: The big CO<sub>2</sub> emitters "electricity, gas, steam and hot water supply" and "mining of coal and lignite" show very high specific emissions also when put in relation to their gross value added (figure 22). The change of specific CO<sub>2</sub> emissions in 1999 compared with 1991 shows, however, that "elec-

Figure 21

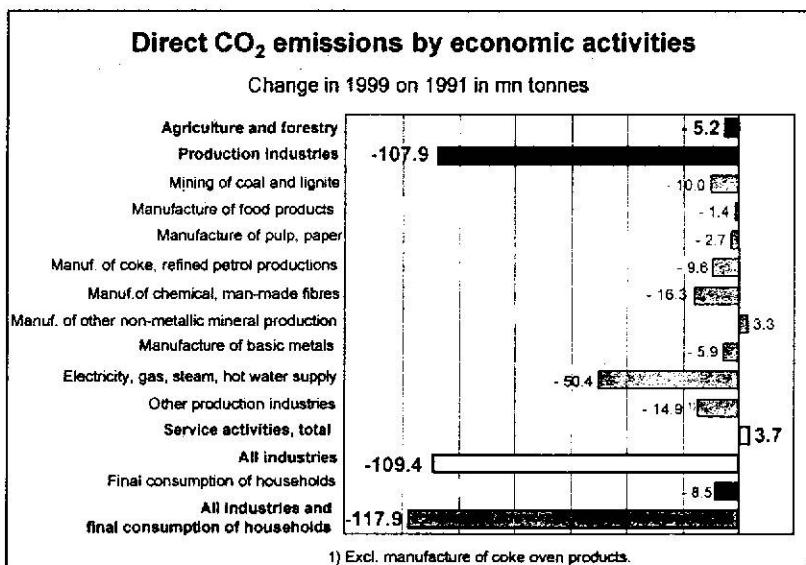
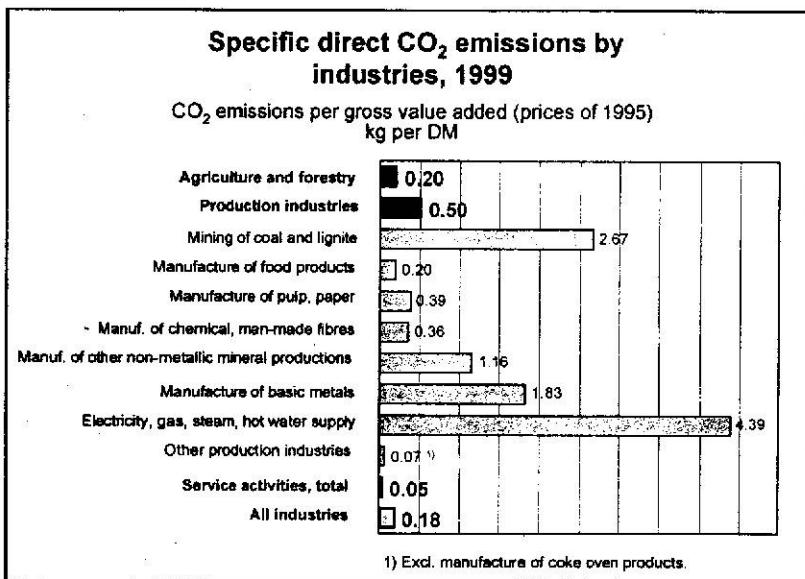
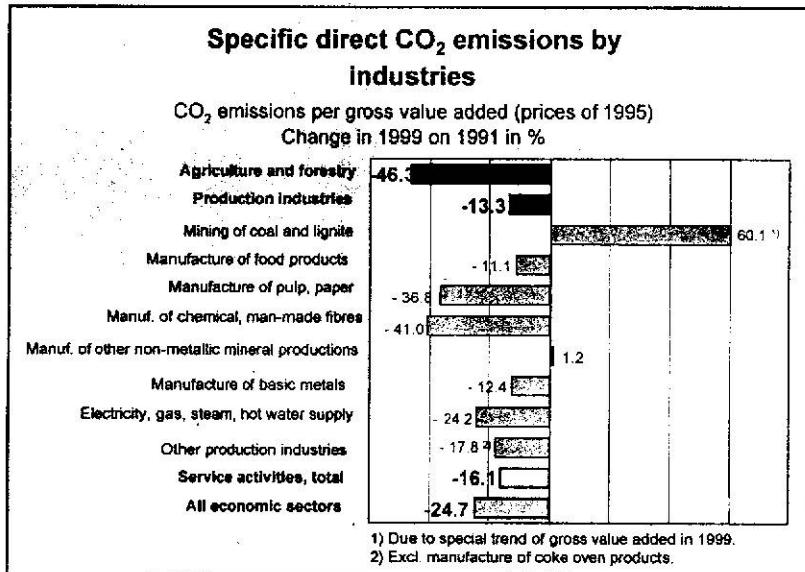


Figure 22



tricity, gas, steam and hot water supply" reduced the specific CO<sub>2</sub> emissions over time, as did most of the other sectors. Among the "big" emitters, only "mining of coal and lignite" showed an increase (figure 23). The marked rise in specific emissions along with falling absolute quantities of emissions in the latter sector is due to special factors connected with the drastic fall in value added there (to about one third).

Figure 23



#### Specific CO<sub>2</sub> emission and CO<sub>2</sub> productivity

The specific CO<sub>2</sub> emission of an industries indicates how much CO<sub>2</sub> emission was produced to obtain one unit of the economic output (value added) produced there:

$$\text{specific CO}_2 \text{ emission} = \frac{\text{CO}_2 \text{ emission}}{\text{gross value added}}$$

The CO<sub>2</sub> productivity of an industries indicates how much economic output (value added) was produced with one unit of the CO<sub>2</sub> emission produced there:

$$\text{CO}_2 \text{ productivity} = \frac{\text{gross value added}}{\text{CO}_2 \text{ emission}}$$

#### Foreign trade

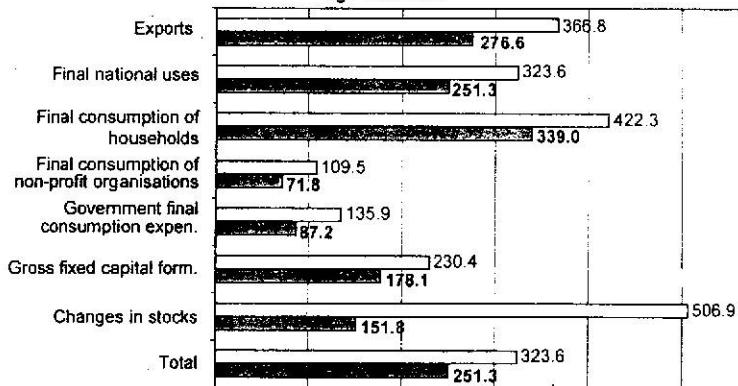
The following section examines the impact of foreign trade flows on CO<sub>2</sub> emissions. Foreign trade is of substantial importance for Germany. Exports and imports have a major share in the goods and services produced and used in Germany and the relative importance of foreign trade flows is increasing. The value of goods consumed or invested in Germany (final national uses) amounted to DM 3,369 bn in 1999, measured in prices of 1995 (see table 32). In the same year, goods to the value of DM 1,017 bn were imported and goods to the value of DM 1,096 bn were exported. Imports rose 45.0% between 1991 and 1999 and exports were up 43.2%, whereas the quantity of goods used for final national uses increased not more than 11.1%.

The production of imported and exported goods involves the creation of CO<sub>2</sub> emissions and other environmental pressures, which cannot be disregarded because of the great, and further growing importance of such flows. What is especially interesting is the question of whether the trend of decreasing environmental pressure in Germany through direct CO<sub>2</sub> emissions is accompanied by a trend towards relocating CO<sub>2</sub>-intensive production activities to other countries.

Figure 24

#### Specific CO<sub>2</sub> emissions

CO<sub>2</sub> emissions per gross value added (prices of 1995)  
kg / 1000 DM



The production of imported goods involved 264.2 mn t of CO<sub>2</sub> emissions in the rest of the world (indirect emissions). The CO<sub>2</sub> emissions created in producing exported goods amounted to a cumulated 303.2 mn t, i.e. taking account of the direct emissions and of the emissions created at all pre-production stages (figure 17).

Between 1991 and 1999 the emissions connected with final national uses decreased by 129 mn t (-13.6%) (figure 18). The decrease was slightly larger than that of direct emissions (-117.9 mn t or -12.1%). As regards CO<sub>2</sub> emissions, the data thus do not support the hypothesis that the comparatively favourable trend of direct CO<sub>2</sub> pressure within Germany might be accompanied by a growing relocation of CO<sub>2</sub>-intensive production to other countries. The picture may be entirely different for other pressure factors, as has been shown in the UGR annual report of 2000 for the withdrawal of raw materials from nature.

The CO<sub>2</sub> emissions involved in imports rose by 11.3 mn t between 1991 and 1999 (+4.5%) and the emissions caused by the production of exported goods increased by 22.4 mn t (+8.0%), whereas – as shown earlier – the emissions connected with final national uses were down by 129 mn t (figure 18). However, those different trends reflect in particular the growing foreign-trade related interconnections of the German national economy.

#### Cumulated CO<sub>2</sub> emissions

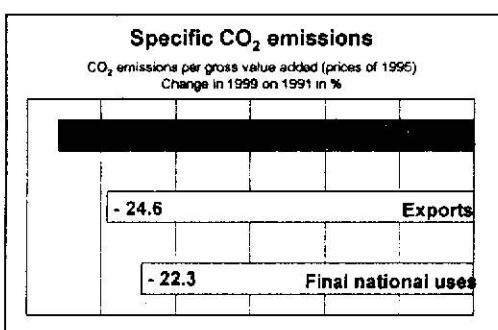
The consumption of energy required for the production of goods and the relevant production of emissions are the direct consequence of a specific activity of industries and households. Therefore, this is referred to as the production of **direct CO<sub>2</sub> emissions**.

CO emissions created during the pre-stages of the production of goods are referred to as **indirect CO<sub>2</sub> emissions**. The quantity of energy required indirectly abroad and the resulting CO emissions can be taken into account by assuming production structures and technologies corresponding to those in Germany.

The total of direct and indirect CO emissions are the **cumulated CO<sub>2</sub> emissions**.

On average, the imported and the exported goods are more CO<sub>2</sub>-intensive than the goods of final national uses. The specific CO<sub>2</sub> emission of imports was 260 kg per DM 1,000 in 1999. The production of exported goods involved the creation of 277 kg of CO<sub>2</sub> per DM 1,000 (figure 24). The specific CO<sub>2</sub> emission of final national uses was 251 kg per DM 1,000.

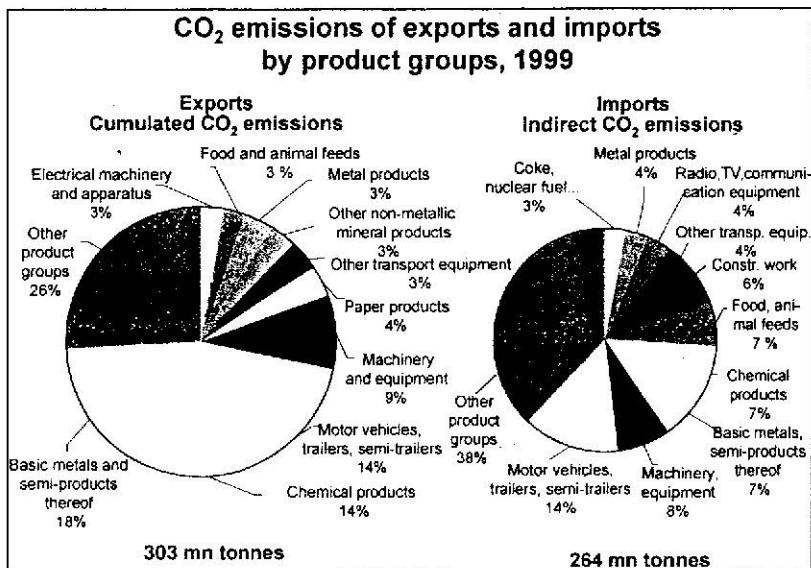
Figure 25



Between 1991 and 1999, the specific CO<sub>2</sub> emission of goods decreased markedly (figure 25); the decline for imported goods was clearly larger – assuming identical production conditions in Germany and abroad – than for final national uses. For imported goods, CO<sub>2</sub> intensity was down 27.9%. For exports, the decrease was 24.6%, while for final national uses it was 22.3%.

The structure of product groups is quite similar for imports and for exports. This reflects the fact that the German national economy is part of a complex international system of division of labour between a number of industrialised national economies. Such similarity between import and export structures becomes also obvious when examining the CO<sub>2</sub> emissions created through the production of foreign trade products (figure 26). Far more than half (55%) of all emissions caused by exports in 1999 regarded the product groups "basic metals and semi-products thereof" (18%), "chemicals, chemical products and man-made fibres" (14%), "motor vehicles, trailers and semi-trailers" (14%) und "machinery and equipment"

**Figure 26**



(9%). In imports, too, those groups have the largest share, although altogether it is clearly smaller there. Together, they account for a good third (36%) of all emissions caused by imports. Other product groups that are relatively important as regards import-related emissions are "food and animal feeds" (7%) and "construction work" (6%).

## Estimating CO<sub>2</sub> emissions

The CO<sub>2</sub> emissions related to foreign trade flows can be estimated by means of input-output analysis. For this purpose, the results of Environmental-Economic Accounting on the energy quantities used for economic activities and relevant for emissions and those on the CO<sub>2</sub> emissions directly produced in that context are linked - using specific model assumptions - with information on interconnections between various economic activities which is contained in the monetary input-output tables of national accounts. One of the assumptions is that the domestic situation of production shall apply to the production of imported goods. So, to put it more precisely, what is measured is not the actual CO<sub>2</sub> emissions produced in the rest of the world but the CO<sub>2</sub> emissions avoided in Germany through imports.

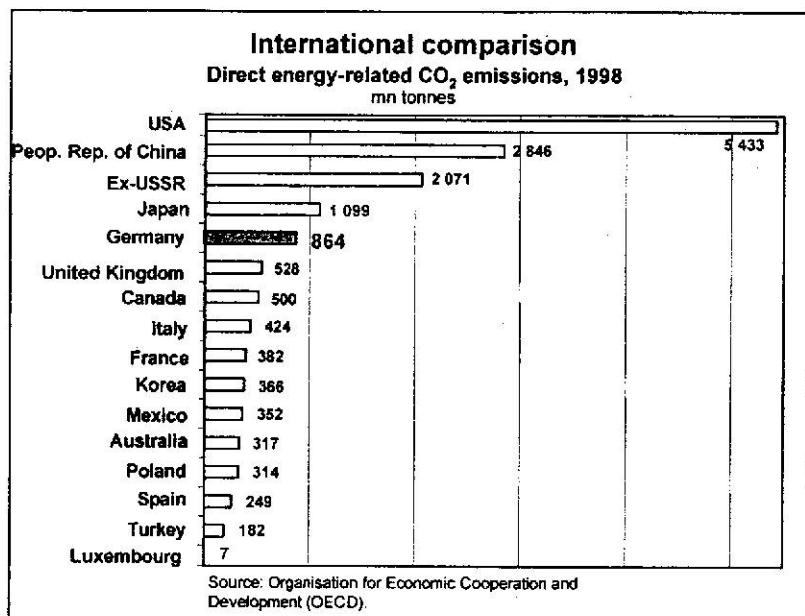
### International comparison

In the Kyoto Protocol of 1997, the industrialised nations have committed themselves to clearly reduce their CO<sub>2</sub> emissions. At the subsequent climate summits in The Hague (2000) and Bonn (2001), the procedure to be followed to achieve those targets was discussed.

In an **international comparison**, Germany ranks among the top group regarding the absolute quantity of CO<sub>2</sub> emissions (figure 27)<sup>2</sup>. Following the USA (5,433 mn t – by far the most important CO<sub>2</sub> emitter worldwide), China (2,846 mn t), the states of the former USSR (2,071 mn t) and Japan (1,099 mn t), Germany ranked fifth (864 mn t of CO<sub>2</sub> emissions) in 1998. Germany's share in worldwide CO<sub>2</sub> emissions was 4.0%. Regarding emissions per inhabitant, Germany (10.5 t) is clearly above the world average (3.9 t), though reflecting roughly the average of the OECD member countries (10.9 t).

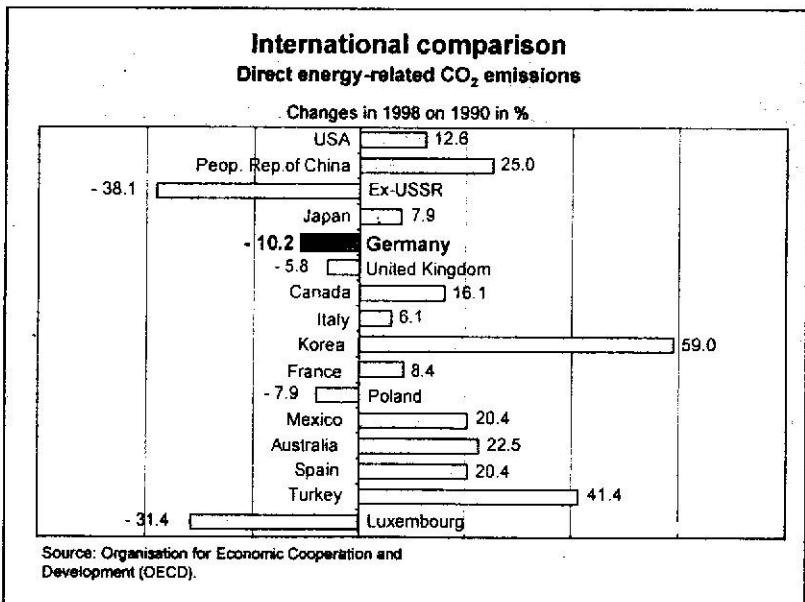
Energy consumption and, indirectly, CO<sub>2</sub> emissions depend – among other things – on the economic structure, climatic conditions, consumption behaviour, and other factors such as the opportunities of making more use of water, wind or solar power.

Figure 27



Germany is one of the few countries that succeeded in the past decade to reduce direct CO<sub>2</sub> emissions. According to OECD data, CO<sub>2</sub> emissions in Germany decreased 10.2% from 1990 to 1998 (figure 28). The only other countries that have reduced their CO<sub>2</sub> emissions were – apart from the former Eastern bloc countries (e.g. ex USSR -38.1%) – Luxembourg (-31.4%) and the United Kingdom (-5.8%). On a global scale, however, CO<sub>2</sub> emissions rose 7.8% in the period examined. For instance, CO<sub>2</sub> emissions increased 12.6% in the USA, 25.0% in China and even 59.0% in Korea.

Figure 28



In Germany, the reduction process was supported by special effects in eastern Germany in the first half of the 1990s caused by German unification (faster structural change, closing down or modernisation of less energy-efficient production plants). According to a study carried out by the *Fraunhofer Institut* in cooperation with the *Deutsches Institut für Wirtschaftsforschung* (DIW – German Institute for Economic Research), the unification-related special factors account for about half of the German volume of reduction.<sup>3</sup> In the former Eastern bloc countries, it is especially the collapse of the centrally planned economies that has a great effect. In Great Britain, the changeover from coal to low-carbon natural gas in electricity production implemented during the past decade was a major factor. The positive development in Luxembourg was clearly influenced by the strong decrease in steel production, which is highly energy-intensive.

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<sup>1</sup> Intergovernmental Panel on Climate Change: IPCC Third Assessment Report – Climate Change 2001. For additional information see <http://www.ipcc.ch>

<sup>2</sup> For an international comparison, only OECD data on energy-related emissions are available. Process-related emissions have not been taken into account. In Germany, process-related emissions accounted for about 3% of all emissions.

<sup>3</sup> Cf. *Fraunhofer Institut* and *Deutsches Institut für Wirtschaftsforschung*: "Greenhouse Gas Reductions in Germany and the UK - Coincidence or Policy induced?"; extracts published in: *Umwelt* 9/2001, p.596 ff.

### Abbreviations - Units

J	=	joule	(1 J = 1 Ws)	mn	=	million
kJ	=	kilojoule	(1 kJ = $10^3$ J)	bn	=	billion
MJ	=	megajoule	(1 MJ = $10^6$ J)	h	=	hour
GJ	=	gigajoule	(1 GJ = $10^9$ J)	m <sup>3</sup>	=	cubic metre
TJ	=	terajoule	(1 TJ = $10^{12}$ J)	%	=	percent
PJ	=	petajoule	(1 PJ = $10^{15}$ J)	m <sup>2</sup>	=	square metre
C.E.	=	coal equivalent	(1 t C.E. = 0.0294 TJ)	km <sup>2</sup>	=	square kilometre
W	=	watt		ha	=	hectare ( = 10,000 m <sup>2</sup> )
Ws	=	watt second		l	=	litre
MWh	=	megawatt hour	( = 3.6 GJ)	pkm	=	person kilometre
kg	=	kilogram				
t	=	tonne				

### Explanation of symbols

0	=	less than half of 1 in the last digit occupied, but more than zero	...	=	data will be available later
			X	=	cell blocked for logical reasons
			.	=	numerical value unknown or not to be disclosed
			-	=	no figures or magnitude zero

Differences in the sum totals may occur due to rounding of figures

Table 1: Population and economy

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Inhabitants	mn	80.0	80.6	81.2	81.4	81.7	81.9	82.1	82.0	82.1	82.2
Active population	mn	40.7	40.5	40.4	40.6	40.5	40.7	41.0	41.2	41.4	41.8
Persons engaged (national concept)	mn	38.5	37.9	37.4	37.3	37.3	37.2	37.1	37.5	38.0	38.6
Unemployed											
Total	mn	2.2	2.6	3.1	3.3	3.2	3.5	3.9	3.7	3.4	3.1
In % of active population	%	5.4	6.4	7.6	8.1	7.9	8.6	9.5	8.9	8.2	7.5
Domestic final consumption											
expenditure of private households	DM bn	1,622	1,660	1,653	1,661	1,692	1,707	1,722	1,757	1,803	...
Hours worked											
Total	bn hours	60.0	59.7	58.1	58.0	57.4	56.6	56.3	56.7	57.0	57.4
Per person engaged (domestic concept)	hours	1,560.4	1,576.4	1,555.8	1,555.0	1,535.3	1,519.1	1,513.2	1,507.0	1,496.2	1,481.7
Capital stock, at prices of 1995											
Total <sup>1)</sup>	DM bn	15,642	16,158	16,647	17,110	17,566	18,000	18,428	18,859	19,304	19,761
Per person engaged (domestic concept)	DM 1,000	406	426	446	459	471	484	496	502	508	511
Per hour worked	DM	261	269	277	285	293	300	307	314	322	329
Consumption of fixed capital, at prices of 1995	DM bn	447	472	492	507	521	535	548	562	579	597
Gross domestic product at prices of 1995											
Total	DM bn	3,346	3,421	3,384	3,463	3,523	3,550	3,600	3,670	3,738	3,850
Per person engaged (domestic concept)	DM	87,000	90,300	90,600	92,800	94,200	95,300	96,700	97,600	98,200	99,500
Per hour worked	DM	56	57	58	60	61	63	64	65	66	67
Per DM 1,000 of consumption of fixed capital	DM	7,486	7,253	6,882	6,828	6,760	6,637	6,574	6,532	6,460	6,449
Memorandum item:											
Persons engaged (domestic concept)	mn	38.5	37.9	37.4	37.3	37.4	37.3	37.2	37.6	38.1	38.7

1) excl. cultivated assets.

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Table 2: Use of environmental resources for economic purposes

		Production factors											
Primary energy consumption	petajoules	14,914	14,467	14,150	14,179	14,078	14,269	14,748	14,599	14,549	14,220	14,173	
Raw mat. withdrawal/imports <sup>2)</sup>	mn t	.	1,480	1,479	1,413	1,533	1,485	1,458	1,440	1,421	1,439	1,432	
Water withdrawal from nature <sup>3)</sup>	mn m <sup>3</sup>	.	51,344	49,852	48,150	48,972	48,909	47,788	47,334	45,502	...	...	
Greenhouse gases <sup>4)</sup>	mn t	1,187	1,146	1,092	1,071	988	1,051	1,066	1,029	1,008	971	...	
Incl.: carbon dioxide	mn t	1,014	976	928	918	904	904	925	894	888	859	861	
Acidification gases <sup>5)</sup>	mn t	7.2	5.7	4.9	4.5	3.9	3.4	2.7	2.4	2.1	2.0	...	
Water discharge into nature <sup>6)</sup>	mn m <sup>3</sup>	.	51,148	49,685	47,966	48,787	48,724	47,601	47,159	45,331	...	...	
Incl.: waste water	mn m <sup>3</sup>	.	43,971	42,375	40,758	41,270	40,740	40,267	40,194	38,557	...	...	
Built-up and traffic land <sup>7)</sup>	km <sup>2</sup>	.	.	.	40,305	.	.	.	42,052	42,503	42,976	43,447	
Hours worked	bn hours	.	60.0	59.7	58.1	58.0	57.4	56.6	56.3	56.7	57.0	57.4	
Cons. fixed cap. (prices of 1995)	DM bn	.	447	472	492	507	521	535	548	562	579	587	
Memorandum item:													
Gross domestic product at prices of 1985	DM bn	.	3,348	3,421	3,384	3,463	3,523	3,560	3,600	3,670	3,736	3,850	
Production factors (Germany, 1991 or 1993 = 100)													
Primary energy consumption	-	103.1	100	97.8	98.0	97.3	98.6	101.8	100.9	100.6	98.3	98.0	
Raw mat. withdrawal/imports <sup>2)</sup>	-	.	100	101.3	96.8	105.0	101.7	98.8	98.6	97.3	98.6	98.1	
Water withdrawal from nature <sup>3)</sup>	-	.	100	97.1	93.8	95.4	95.3	93.1	92.2	88.6	...	...	
Greenhouse gases <sup>4)</sup>	-	104.4	100	95.2	93.4	86.2	91.7	93.0	89.7	87.9	84.7	...	
Incl.: carbon dioxide	-	103.9	100	95.0	94.0	92.6	92.6	94.7	91.5	91.0	87.9	88.2	
Acidification gases <sup>5)</sup>	-	125.7	100	85.7	78.0	67.9	58.7	47.3	41.3	36.4	34.4	...	
Water discharge into nature <sup>6)</sup>	-	.	100	97.1	93.8	95.4	95.3	93.1	92.2	88.6	...	...	
Incl.: waste water	-	.	100	96.4	92.7	93.8	92.7	91.6	91.4	87.7	...	...	
Built-up and traffic land <sup>7)</sup>	-	.	.	.	100	.	.	.	104.3	105.5	108.6	107.8	
Hours worked	-	.	100	99.5	96.8	98.7	95.6	94.4	93.8	94.5	95.0	95.6	
Cons. fixed cap. (prices of 1995)	-	.	100	105.5	110.0	113.5	116.6	119.7	122.5	125.7	129.5	133.6	
Gross domestic product in relation to production factors (Germany, 1991 or 1993 = 100)													
Primary energy consumption	-	.	100	104.5	103.2	106.4	106.7	104.1	106.6	109.1	113.6	117.5	
Raw mat. withdrawal/imports <sup>2)</sup>	-	.	100	100.9	104.5	98.5	103.5	106.3	109.1	112.7	113.3	117.3	
Water withdrawal from nature <sup>3)</sup>	-	.	100	105.3	107.8	106.5	110.5	114.0	116.7	123.8	...	...	
Greenhouse gases <sup>4)</sup>	-	.	100	107.3	108.2	120.0	114.9	114.1	119.9	124.7	131.8	...	
Incl.: carbon dioxide	-	.	100	107.6	107.6	111.8	113.7	112.0	117.5	120.6	127.0	130.5	
Acidification gases <sup>5)</sup>	-	.	100	119.3	129.7	152.4	179.5	224.3	260.5	301.0	325.0	...	
Water discharge into nature <sup>6)</sup>	-	.	100	105.3	107.8	108.5	110.5	114.0	118.7	123.8	...	...	
Incl.: waste water	-	.	100	106.1	108.1	110.3	113.6	115.9	117.7	125.1	...	...	
Built-up and traffic land <sup>7)</sup>	-	.	.	.	100	.	.	.	102.0	102.8	103.6	105.6	
Hours worked	-	.	100	102.7	104.4	107.1	110.1	112.4	114.7	116.1	117.6	120.4	
Cons. fixed cap. (prices of 1995)	-	.	100	96.9	91.9	91.2	90.3	88.7	87.8	87.2	86.3	86.1	

1) In part estimated.

2) Withdrawal of abiotic raw materials subsequently used and imported abiotic goods.

3) Incl. foreign water and rainwater.

4) Greenhouse gases included are carbon dioxide, dinitrogen monoxide and methane. They have been grouped to CO<sub>2</sub> equivalents by means of conversion factors (CO<sub>2</sub> emission x 1; N<sub>2</sub>O emission x 310; CH<sub>4</sub> emission x 21).

5) Sulphur dioxide and nitrogen oxides have been grouped to acidification gases by means of conversion factors (SO<sub>2</sub> emission x 1; NO<sub>x</sub> emission x 0.7).

6) Incl. foreign water and rainwater, losses occurring in water distribution and evaporation.

7) According to area survey, (reference day: 31 December of preceding year, i.e. reference years 1992 and 1996) and preliminary estimate by the Federal Office of Building and Regional Planning (reference day: 31 December of preceding year).

**Table 3: Direct use of environmental resources in private household consumption**

		1980	1981	1982	1983	1984	1985	1986
Inhabitants	mn	80	81	82	82	82	82	2.6
Number of households	mn	35	36	37	38	38	38	7.1
Final consumption expenditure (prices of 1995)	DM bn	1,622	1,653	1,691	1,722	1,757	1,803	11.2
Direct energy consumption	petajoules	3,767	3,870	3,946	4,147	4,084	4,227	12.2
Material consumption	mn t	.	.	193	.	.	.	-
Emissions of carbon dioxide	mn t	219	224	216	228	223	211	- 3.9
Waste production	mn t	28	29	29	.	.	.	4.8 <sup>1)</sup>
Water use	mn m <sup>3</sup>	3,551	.	3,313	.	3,250	.	- 8.5 <sup>2)</sup>
Waste water	mn m <sup>3</sup>	3,409	.	3,180	.	3,254	.	- 4.5 <sup>2)</sup>
Built-up and traffic area	km <sup>2</sup>	.	23,120	.	24,080	.	.	4.2 <sup>3)</sup>

1) In 1996 from 1991. - 2) In 1998 from 1991. - 3) In 1997 from 1993.

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**Table 4: Use of environmental resources for economic purposes \*)  
Western Germany**

Production factors					
Primary energy consumption	petajoules	6,198	9,870	11,436	11,495
Raw material withdrawal/imports <sup>1)</sup>	mn t	757	1,079	1,195	1,130
Water withdrawal from nature <sup>2)</sup>	mn m <sup>3</sup>	20,260	-	-	46,440
Greenhouse gases <sup>3)</sup>	mn t	555	907	950	857
Incl.: CO <sub>2</sub>	mn t	555	744	792	709
Acidification gases <sup>4)</sup>	mn t	4	5	5	2
Waste	mn t	218.9	-	-	320.4
Water discharge into nature <sup>5)</sup>	mn m <sup>3</sup>	20,053	-	-	46,207
Built-up and traffic area <sup>6)</sup>	km <sup>2</sup>	18,780	-	27,310	30,452
Hours worked	bn hours	56	52	47	46
Consumption of fixed capital (prices of 1995)	DM bn	78	158	242	318
Memorandum item:					
Gross domestic product, unrevised, at prices of 1991	DM bn	1,000	1,543	2,018	2,520
Production factors (1960 = 100)					
Primary energy consumption	-	100	159.2	184.5	185.5
Raw material withdrawal/imports <sup>1)</sup>	-	100	142.5	157.8	149.2
Water withdrawal from nature <sup>2)</sup>	-	100	-	-	229.2
Greenhouse gases <sup>3)</sup>	-	100	163.4	171.1	154.5
Incl.: CO <sub>2</sub>	-	100	134.1	142.7	127.7
Acidification gases <sup>4)</sup>	-	100	117.2	113.0	51.9
Waste	-	100	-	-	146.4
Water discharge into nature <sup>5)</sup>	-	100	-	-	230.4
Built-up and traffic area <sup>6)</sup>	-	100	-	145.4	162.2
Hours worked	-	100	92.3	84.0	82.4
Consumption of fixed capital (prices of 1995)	-	100	202.2	309.8	407.3
Gross domestic product in relation to production factors (1960 = 100)					
Primary energy consumption	-	100	96.9	109.4	135.9
Raw material withdrawal/imports <sup>1)</sup>	-	100	108.3	127.9	169.0
Water withdrawal from nature <sup>2)</sup>	-	100	-	-	110.0
Greenhouse gases <sup>3)</sup>	-	100	94.4	117.9	163.1
Incl.: CO <sub>2</sub>	-	100	115.1	141.4	197.3
Acidification gases <sup>4)</sup>	-	100	131.7	178.5	486.0
Water discharge into nature <sup>5)</sup>	-	100	-	-	109.4
Built-up and traffic area <sup>6)</sup>	-	100	-	138.8	155.4
Hours worked	-	100	167.1	240.4	306.0
Consumption of fixed capital (prices of 1995)	-	100	76.3	65.1	61.9

\*) Data in part estimated.

1) Withdrawal of abiotic raw materials subsequently used and imported abiotic goods.

2) Incl. foreign water and rainwater.

3) Greenhouse gases included are carbon dioxide, dinitrogen monoxide and methane. They have been grouped to CO<sub>2</sub> equivalents by means of conversion factors (CO<sub>2</sub> emission x 1; N<sub>2</sub>O emission x 310; CH<sub>4</sub> emission x 21).

4) Sulphur dioxide and nitrogen oxides have been grouped to acidification gases by means of conversion factors (SO<sub>2</sub> emission x 1; NO<sub>x</sub> emission x 0.7).

5) Incl. foreign water and rainwater, losses occurring in water distribution and evaporation.

6) According to area survey; (reference day: 31 December of preceding year).

Table 5: Material and energy flows

mn t

	Solids and gases <sup>1)</sup>									
	5,121	4,697	4,779	4,717	4,508	4,438	4,276	4,151	4,098	
Withdrawal	3,968	3,559	3,681	3,589	3,380	3,285	3,139	2,996	2,981	
Raw material withdrawal (domestic territory)	2,686	2,336	2,422	2,259	2,089	2,021	1,897	1,791	1,741	
Withdrawal of material (unused) <sup>2)</sup>	1,282	1,223	1,260	1,330	1,291	1,263	1,242	1,205	1,240	
Withdrawal of material (used)	188	130	205	191	202	212	215	216	214	
Biotic substances	1,094	1,093	1,054	1,140	1,080	1,051	1,027	989	1,026	
Abiotic substances	364	325	296	277	265	256	244	226	221	
Energy sources	0	0	0	0	0	0	0	1	1	
Ores	730	768	758	862	825	795	783	763	805	
Non-metallic minerals	433	456	423	463	464	475	482	505	489	
Imports	68	70	64	69	69	69	70	73	76	
Biotic goods	365	386	359	394	395	406	413	431	413	
Abiotic goods	203	210	208	217	214	238	238	246	237	
Energy sources	74	74	63	75	78	70	76	85	76	
Ores and products thereof	51	64	56	64	64	59	57	54	54	
Non-metallic minerals and products thereof	23	23	21	24	24	25	27	29	28	
Chemical products	8	8	6	7	8	8	9	10	11	
Machinery and equipment	6	6	5	6	7	6	7	8	8	
Other goods	719	683	675	664	664	678	655	651	629	
Withdrawal of oxygen	4,390	3,988	4,044	3,901	3,729	...	...	...	...	
Discharge	295	284	283	284	283	283	278	277	274	
Application of material	294	283	282	283	282	282	277	276	273	
Fertilizers	0	0	0	0	0	0	0	0	0	
Pesticides	1	1	1	1	1	1	1	1	1	
Sewage sludge	2,527	2,167	2,258	2,091	1,934	1,875	1,751	1,638	1,588	
Discharge of unused material <sup>3)</sup>	211	216	202	223	225	238	249	260	265	
Exports	52	54	51	57	60	60	61	67	71	
Biotic goods	158	162	151	168	165	178	188	193	195	
Abiotic goods	21	23	22	25	25	35	32	34	32	
Energy sources	37	37	36	38	38	37	43	41	41	
Ores and products thereof	50	50	41	48	45	46	48	50	52	
Non-metallic minerals and products thereof	30	30	32	34	34	36	38	39	41	
Chemical products	12	12	10	11	12	13	15	16	17	
Machinery and equipment	9	10	9	10	11	12	12	13	13	
Other goods	354	371	363	379	365	...	...	...	...	
Waste, total <sup>4)</sup>	1,002	950	938	923	922	941	909	902	872	
Balance of solids and gases	731	709	735	816	778	...	...	...	...	
	Water									
Withdrawal of water from nature <sup>5)</sup>	51,344	49,852	48,150	48,972	48,809	47,786	47,334	45,502	...	
Discharge of water into nature <sup>6)</sup>	51,148	49,665	47,966	46,787	46,724	47,601	47,159	45,331	...	
Balance of water exports and imports	8	8	8	8	8	7	7	7	...	
Balance of water	189	179	176	177	177	178	168	164	...	
	Total									
Material retained	920	888	911	993	956	...	...	...	...	

1) Incl. non-solid energy sources, sludges, acids and alkalis.

2) Incl. excavated earth, hard coal slag, excavated material of brown coal.

3) Incl. excavated material of brown coal and hard coal slag not filled into underground space.

4) Incl. excavated earth, building and road demolition waste, hard coal slag filled into underground space.

5) Incl. foreign water and rainwater.

6) Incl. foreign water and rainwater, losses occurring in water distribution and evaporation.

Table 6: Detailed material and energy flows, 1998  
mn t

Solids <sup>1)</sup>			
Raw material withdrawal (domestic territory)	2,996.0	Application of material	276.7
Withdrawal of material (unused)	1,791.2	Fertilizers	275.5
Brown coal	1,619.5	Manure	270.3
Hard coal	41.4	Commercial fertilizers (nutrients)	5.2
Other energy sources	1.1	Pesticides	0.0
Ores	0.0	Sewage sludge	1.2
Non-metallic minerals, stones and earth	34.0	Discharge of unused material <sup>2)</sup>	1,638.4
Excavated earth <sup>3)</sup>	95.1	Exports	259.9
Withdrawal of material (used)	1,204.8	Biotic goods	66.6
Biotic materials	215.6	Animals and animal products	0.0
Animals	0.2	Plants and vegetable products <sup>4)</sup>	7.9
Plants	186.5	Wood and wood products	37.3
Wood	28.9	Abiotic goods	193.3
Abiotic materials	989.3	Energy sources	33.8
Energy sources	226.0	Ores and products thereof	41.1
Hard coal	40.7	Non-metallic minerals <sup>5)</sup>	49.8
Brown coal	166.0	Chemical products	39.1
Mineral oil	2.9	Machinery and equipment	16.3
Natural gas	15.8	Other goods	13.2
Petroleum gas	0.1	Waste	...
Energetic peat	0.2	Excavated earth	...
Other products of mineral oil and	0.3	Building and road demolition waste	...
natural gas extraction		Slag	...
Ores	0.6	Waste excl. mass waste	...
Iron and manganese ores	0.6	Total	...
Non-ferrous ores	0.0		...
Sulphur and magnetic pyrites	0.0		...
Other ores	0.0		...
Non-metallic minerals	762.6		...
Stones and earths	738.8		...
Raw and unbroken natural stones,			...
crude earths	240.1		...
Sand and gravel	370.6		...
Limestone and dolomite	72.4		...
Gypsum and chalk, anhydrite	4.7		...
Raw materials containing alumina	44.7		...
Quartzite, feldspar, pegmatite	2.4		...
Other raw and broken natural stones	0.5		...
Peat for gardening	3.3		...
Minerals and products thereof	23.9		...
Salts	22.6		...
Natural raw potassic salts	7.8		...
Rock salts, metallurgical salts,			...
sealine salts, de-icing salts, spring			...
salts	14.8		...
Fluor spar, barytes and graphite	0.2		...
Sulphur from natural gas extraction	1.1		...
Other mining products	0.0		...
Imports	504.7		...
Biotic goods	73.3		...
Animals and animal products	6.4		...
Plants and vegetable products <sup>4)</sup>	41.1		...
Wood and wood products	25.8		...
Abiotic goods	431.4		...
Energy sources	246.3		...
Ores and products thereof	84.9		...
Non-metallic minerals <sup>5)</sup>	53.7		...
Chemical products	28.7		...
Machinery and equipment	9.9		...
Other goods	8.0		...
Total	3,500.7	Balance of solids	

**Table 6: Detailed material and energy flows, 1998**  
mn t

Gases			
Withdrawal of oxygen		Air emissions of mass pollutants	
for the formation of carbon dioxide (CO <sub>2</sub> )	646.0	Carbon dioxide (CO <sub>2</sub> )	888.2
for the formation of carbon monoxide (CO)	3.1	Carbon monoxide (CO)	5.3
for the formation of nitrogen dioxide (NO <sub>2</sub> )	1.2	Nitrogen dioxide (NO <sub>2</sub> )	1.7
for the formation of sulphur dioxide (SO <sub>2</sub> )	0.4	Sulphur dioxide (SO <sub>2</sub> )	0.9
for the formation of dinitrogen oxide (N <sub>2</sub> O)	0.1	Dinitrogen oxide (N <sub>2</sub> O)	0.2
Total	650.7	Ammonia (NH <sub>3</sub> )	0.6
		Methane (CH <sub>4</sub> )	3.4
		Dust	0.3
		Volatile organic compounds, excl. methane (NMVOC)	1.7
		Total	902.3
		Balance of gases	- 251.6
		Balance of solids and gases	...
Water			
Water withdrawal from nature	45,501.9	Water discharge into nature	45,330.7
Foreign and rain water <sup>6)</sup>	4,734.2	Foreign and rain water <sup>6)</sup>	4,734.2
Groundwater, spring and surface water, bank filtrate	40,767.7	Waste water	38,556.6
		Evaporation	1,439.5
		Losses	600.4
		Balance of water exports and imports	5.7
Total	45,501.9	Total	45,337.4
		Balance of water <sup>7)</sup>	164.5
		Material retained	...

1) Incl. non-solid energy sources, sludges, acids and alkalis.

2) Incl. excavated material of brown coal and hard coal slag not filled into underground space.

3) Estimated. - 4) Excl. wood. - 5) And products thereof.

6) Withdrawal through sewage system (e.g. drainage of sealed areas).

7) Transformation into other types of materials.

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**Table 7: Environmental protection expenditure \*)**  
at prices of 1995

		1990	1991	1992	1993	1994	1995	1996	1997	1998
Environmental protection expenditure, total <sup>1)</sup>	DM mn				67,510	69,320	70,320	66,300	...	...
Share in gross domestic product	%	X	X	X	1.9	2.0	2.0	1.8	...	...
Of which:										
Production industries <sup>2)3)</sup>	DM mn	17,400	18,210	18,410	18,270	17,510	17,960	15,450	12,170	...
Government	DM mn	28,390	31,770	29,650	28,980	27,440	24,800	21,970	20,600	...
Privatised public enterprises <sup>4)</sup>	DM mn	.	.	.	20,260	24,370	27,560	28,880	...	...
Investments in environmental protection	DM mn	.	.	.	30,020	27,460	25,270	22,700	...	...
Share in total investments	%	X	X	X	3.8	3.5	3.2	2.9	...	...
Of which:										
Production industries <sup>2)</sup>	DM mn	6,300	6,680	6,470	6,020	5,050	4,910	3,460	3,090	...
Government	DM mn	14,840	16,890	14,640	13,500	11,980	9,860	8,560	7,570	...
Privatised public enterprises <sup>4)</sup>	DM mn	.	.	.	10,500	10,430	10,500	10,580	...	...
Current expenditure for environmental protection	DM mn	.	.	.	37,490	41,860	45,050	43,610	...	...
Of which:										
Production industries <sup>2)3)5)</sup>	DM mn	11,100	11,530	11,940	12,250	12,460	13,050	12,000	9,080	...
Government	DM mn	13,550	14,880	15,010	15,480	15,460	14,940	13,410	13,030	...
Privatised public enterprises <sup>4)</sup>	DM mn	.	.	.	9,760	13,940	17,060	18,200	...	...

\*) 1998: provisional results.

1) Environmental protection expenditure = Total of investments and current expenditure for environmental protection purposes.

2) Excl. construction industry and expenditure for integrated environmental protection measures.

3) 1998: excl. current expenditure of electricity, gas, steam and hot water supply and of collection, purification and distribution of water.

4) This item covers expenditure of enterprises outside public budgets, especially municipal public utility undertakings in waste disposal and water protection. Both in Environmental-Economic Accounting and in national accounts, they are considered as part of the enterprises, rather than of the government sector. Consistent data are available only from reference year 1994.

5) Excl. fees and remuneration for disposal services rendered by third parties.

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**Table 8: Environmental protection expenditure by environmental protection areas, 1997**

current prices

DM mn

Environmental protection area	Investments in environmental protection	Current expenditure for environmental protection	Expenditure for integrated environmental protection measures	Expenditure for environmental protection purposes	Agricultural control
Environmental protection expenditure, total 1)	66,530	26,720	32,510	690	6,630
Of which:					
Production industries <sup>2)</sup>	15,440	3,200	5,340	360	6,540
Government	22,040	9,230	12,400	330	90
Privatised public enterprises <sup>3)</sup>	29,050	14,290	14,770	-	-
Investments in environmental protection	22,370	4,340	15,850	520	1,670
Of which:					
Production industries <sup>2)</sup>	3,550	510	1,230	190	1,620
Government	8,350	840	7,140	330	50
Privatised public enterprises <sup>3)</sup>	10,470	2,990	7,480	-	-
Current expenditure for environmental protection	44,160	22,380	16,660	180	4,960
Of which:					
Production industries <sup>2) 4)</sup>	11,890	2,690	4,110	180	4,920
Government	13,690	8,390	5,260	-	40
Privatised public enterprises <sup>3)</sup>	18,580	11,300	7,290	-	-

1) Environmental protection expenditure = Total of investments and current expenditure for environmental protection purposes.

2) Excl. construction industry and expenditure for integrated environmental protection measures.

3) This item covers expenditure of enterprises outside public budgets, especially municipal public utility undertakings in waste disposal and water protection. Both in Environmental-Economic Accounting and in national accounts, they are considered as part of the enterprises, rather than of the government sector. Consistent data are available only from reference year 1994.

4) Excl. fees and remuneration for disposal services rendered by third parties.

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**Table 9: Gross fixed assets for environmental protection \*)**

at prices of 1995

DM mn

	1995	1996	1997	1998	1999	1995	1996	1997	1998	1999
Gross fixed assets for environmental protection	402,290	416,510	432,870	447,510	460,180	459,950	477,030	480,910	482,960	
Of which:										
Waste disposal	24,500	26,980	30,230	32,360	33,780	35,030	36,010	36,470	36,650	
Water protection	321,230	330,440	340,990	351,140	360,190	367,570	372,790	376,740	379,550	
Noise abatement	7,550	8,010	8,430	8,840	9,220	9,540	9,830	10,170	10,610	
Air quality control	49,010	51,080	53,220	55,170	57,000	57,820	58,400	57,530	56,150	

\*) Gross fixed assets of the government and of production industries (excl. construction industry and excl. fixed assets from integrated environmental protection investments). Stock at the beginning of any year. 1998 and 1999: preliminary results.

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**Table 10: Revenue from environment-related taxes and total tax revenue**

DM mn

	GDP (in current prices) budget				
	Total	Trade taxes	Trade and excise taxes	Excise taxes	Environment-related taxes
<b>Western Germany</b>					
1980	364,916	27,936	21,351	6,585	-
1985	437,199	31,871	24,521	7,350	-
1990	549,667	42,935	34,621	8,314	-
<b>Germany</b>					
1991	661,919	58,277	47,266	11,011	-
1992	731,730	68,483	55,166	13,317	-
1993	749,119	70,358	56,300	14,058	-
1994	786,159	78,016	63,847	14,169	-
1995	814,284	78,693	64,888	13,805	-
1996	848,705	81,994	68,251	13,743	-
1997	853,055	80,426	66,008	14,418	-
1998	893,343	81,848	66,677	15,171	-
1999	952,178	88,596	71,278	13,767	3,551
2000	982,658	94,265	73,982	13,720	6,563

<sup>1)</sup> Before deduction of children's allowance (children's allowance paid by the government to inactive persons and tax deductible children's allowance paid by employers to their employees).

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**Table 11: Taxed mineral oil**

	Revenue	Production	Trade in stock	Natural gas
1991	40,643	25,890	41,752	692
1992	41,103	27,387	41,671	676
1993	41,606	28,782	41,758	720
1994	40,094	29,324	39,543	731
1995	40,067	30,425	39,208	807
1996	40,329	30,733	43,749	889
1997	40,645	31,423	41,702	845
1998	40,793	32,487	39,351	803
1999	40,898	34,018	33,412	762
2000	39,045	33,780	30,772	780

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Table 12: Gross value added (prices of 1995)

DM billion

		1995	1995	1995	1995	1995	1995
<b>A-B</b>	<b>Agriculture, forestry and fishing</b>	39.3	42.2	45.1	44.9	45.9	47.5
<b>C-F</b>	<b>Production industries, total</b>	1,093.6	1,060.8	1,033.4	1,049.1	1,058.2	1,046.4
10	Mining of coal and lignite, extraction of peat	14.8	10.8	8.7	6.0	5.7	5.5
13, 14	Mining and quarrying, except of energy producing materials	5.4	6.5	5.8	5.1	5.4	5.4
15	Manufacture of food products	63.2	67.3	64.7	66.2	62.1	64.2
17	Manufacture of textiles	16.2	11.6	10.8	11.0	10.8	9.7
20	Manufacture of wood and wood products, except furniture	13.9	17.2	16.8	17.3	16.6	16.4
21	Manufacture of pulp, paper and paper products	16.6	15.1	16.5	16.4	18.5	19.3
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	8.1	4.5	3.8	4.8	5.7	2.7
24	Manufacture of chemicals, chemical products and man-made fibres	71.7	78.9	77.9	79.1	79.4	76.6
25	Manufacture of rubber and plastic products	34.6	36.1	34.9	37.8	39.3	38.3
26	Manufacture of other non-metallic mineral products	30.4	35.2	32.6	32.2	32.6	32.9
27	Manufacture of basic metals	31.4	31.2	30.7	32.0	32.3	32.6
28	Manufacture of fabricated metal products, except machinery and equipment	69.3	68.2	64.3	65.1	67.3	67.5
29	Manufacture of machinery and equipment	124.8	108.3	105.5	106.2	112.0	105.2
31	Manufacture of electrical machinery and apparatus n.e.c.	66.1	54.6	54.2	55.2	54.7	57.9
32	Manufacture of radio, television and communication equipment and apparatus	18.2	14.7	14.2	15.8	16.9	20.6
34	Manufacture of motor vehicles, trailers and semi-trailers	98.2	86.8	82.1	88.7	93.0	86.0
35	Manufacture of other transport equipment	18.1	10.2	11.8	13.6	14.2	17.2
40	Electricity, gas, steam and hot water supply	59.0	63.0	69.1	66.2	67.2	...
41	Collection, purification and distribution of water	9.4	7.7	7.7	8.7	8.7	...
45	Construction	201.8	223.0	214.1	210.8	206.7	206.2
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	126.4	109.9	107.2	108.8	109.1	107.4
<b>G-Q</b>	<b>Service activities, total</b>	1,984.0	2,192.4	2,253.6	2,300.6	2,368.6	2,448.4
51-52	Commission trade and wholesale trade, retail trade (except of motor vehicles and motorcycles); repair of personal and household goods	278.8	304.2	303.7	301.2	305.5	313.6
60	Land transport; transport via pipelines	63.0	57.8	58.8	57.6	57.5	61.7
62	Air transport	6.3	11.9	13.4	14.2	14.4	14.2
75	Public administration and defence; compulsory social security	212.1	218.4	219.9	218.3	217.6	216.1
50, 59, 61, 63-67, 70-74, 80-95	Other service activities	1,423.8	1,600.2	1,657.8	1,709.3	1,773.6	1,842.8
<b>A-Q</b>	<b>All industries</b>	3,116.8	3,295.4	3,332.1	3,394.6	3,472.7	3,542.3
	Memorandum item: Domestic final consumption expenditure of private households	1,621.6	1,691.3	1,706.8	1,722.0	1,757.3	1,803.0

**Table 13: Gross value added (prices of 1995)**

1991 = 100

		DE	GB	SP	FR	IT	NL
A-B	<b>Agriculture, forestry and fishing</b>	100	107.5	114.7	114.2	117.0	121.0
C-F	<b>Production industries, total</b>	100	97.0	94.5	95.9	96.8	95.7
10	Mining of coal and lignite, extraction of peat	100	73.1	58.7	40.1	38.3	37.2
13, 14	Mining and quarrying, except of energy producing materials	100	119.4	107.4	94.6	99.3	99.1
15	Manufacture of food products	100	106.5	102.5	104.8	98.3	101.6
17	Manufacture of textiles	100	71.6	66.8	67.7	67.0	60.1
20	Manufacture of wood and wood products, except furniture	100	123.6	120.8	124.3	119.3	117.7
21	Manufacture of pulp, paper and paper products	100	90.7	98.9	110.8	111.3	116.1
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	100	55.4	47.3	59.4	70.4	32.7
24	Manufacture of chemicals, chemical products and man-made fibres	100	109.9	108.6	110.3	110.7	106.8
25	Manufacture of rubber and plastic products	100	104.4	100.9	109.4	113.7	111.0
26	Manufacture of other non-metallic mineral products	100	115.8	107.2	105.9	107.1	108.2
27	Manufacture of basic metals	100	99.5	98.0	102.0	103.0	103.8
28	Manufacture of fabricated metal products, except machinery and equipment	100	98.4	92.8	94.0	97.0	97.3
29	Manufacture of machinery and equipment	100	86.8	84.5	85.1	89.8	84.3
31	Manufacture of electrical machinery and apparatus n.e.c.	100	82.5	81.9	83.5	82.6	87.6
32	Manufacture of radio, television and communication equipment and apparatus	100	80.7	77.9	86.7	92.7	113.4
34	Manufacture of motor vehicles, trailers and semi-trailers	100	90.3	85.3	92.2	96.7	89.3
35	Manufacture of other transport equipment	100	63.7	73.7	84.9	88.7	106.8
40	Electricity, gas, steam and hot water supply	100	106.8	117.1	112.3	113.9	..
41	Collection, purification and distribution of water	100	82.2	81.9	92.2	93.0	..
45	Construction	100	110.5	106.1	104.5	102.5	102.2
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	100	86.9	84.8	86.1	86.3	84.9
G-Q	<b>Service activities, total</b>	100	110.5	113.6	116.0	119.4	123.4
51-52	Commission trade and wholesale trade, retail trade (except of motor vehicles and motorcycles); repair of personal and household goods	100	109.1	109.0	108.0	109.6	112.5
60	Land transport; transport via pipelines	100	91.7	93.4	91.5	91.2	98.0
62	Air transport	100	187.4	211.4	224.5	227.8	224.6
75	Public administration and defence; compulsory social security	100	103.0	103.7	102.9	102.6	101.9
50, 58, 61, 63-67, 70-74, 80-95	Other service activities	100	112.4	116.4	120.1	124.6	129.4
A-Q	<b>All industries</b>	100	105.7	106.9	108.9	111.4	113.7
	<b>Memorandum item:</b> <b>Domestic final consumption expenditure of private households</b>	100	104.3	105.3	106.2	108.4	111.2

Table 14: Gross value added (prices of 1995)

Percent

		1991	1992	1993	1994	1995	1996
A-B	<b>Agriculture, forestry and fishing</b>	1.3	1.3	1.4	1.3	1.3	1.3
C-F	<b>Production industries, total</b>	35.1	32.2	31.0	30.9	30.5	29.5
10	Mining of coal and lignite, extraction of peat	0.5	0.3	0.3	0.2	0.2	0.2
13, 14	Mining and quarrying, except of energy producing materials	0.2	0.2	0.2	0.2	0.2	0.2
15	Manufacture of food products	2.0	2.0	1.9	2.0	1.8	1.8
17	Manufacture of textiles	0.5	0.4	0.3	0.3	0.3	0.3
20	Manufacture of wood and wood products, except furniture	0.4	0.5	0.5	0.5	0.5	0.5
21	Manufacture of pulp, paper and paper products	0.5	0.5	0.5	0.5	0.5	0.5
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	0.3	0.1	0.1	0.1	0.2	0.1
24	Manufacture of chemicals, chemical products and man-made fibres	2.3	2.4	2.3	2.3	2.3	2.2
25	Manufacture of rubber and plastic products	1.1	1.1	1.0	1.1	1.1	1.1
26	Manufacture of other non-metallic mineral products	1.0	1.1	1.0	0.9	0.9	0.9
27	Manufacture of basic metals	1.0	0.9	0.9	0.9	0.9	0.9
28	Manufacture of fabricated metal products, except machinery and equipment	2.2	2.1	1.9	1.9	1.9	1.9
29	Manufacture of machinery and equipment	4.0	3.3	3.2	3.1	3.2	3.0
31	Manufacture of electrical machinery and apparatus n.e.c.	2.1	1.7	1.6	1.6	1.6	1.6
32	Manufacture of radio, television and communication equipment and apparatus	0.6	0.4	0.4	0.5	0.5	0.6
34	Manufacture of motor vehicles, trailers and semi-trailers	3.1	2.6	2.5	2.6	2.7	2.4
35	Manufacture of other transport equipment	0.5	0.3	0.4	0.4	0.4	0.5
40	Electricity, gas, steam and hot water supply	1.9	1.9	2.1	2.0	1.9	...
41	Collection, purification and distribution of water	0.3	0.2	0.2	0.3	0.3	...
45	Construction	6.5	6.8	6.4	6.2	6.0	5.8
11-12, 16, 18-19, 22, 30-33, 36-37	Other production industries	4.1	3.3	3.2	3.2	3.1	3.0
G-Q	<b>Service activities, total</b>	63.7	66.5	67.6	67.8	68.2	69.1
51-52	Commission trade and wholesale trade, retail trade (except of motor vehicles and motorcycles); repair of personal and household goods	8.9	9.2	9.1	8.9	8.8	8.9
60	Land transport; transport via pipelines	2.0	1.8	1.8	1.7	1.7	1.7
62	Air transport	0.2	0.4	0.4	0.4	0.4	0.4
75	Public administration and defence; compulsory social security	6.8	6.6	6.6	6.4	6.3	6.1
50, 59, 61, 63-67, 70-74, 80-95	Other service activities	45.7	48.6	49.8	50.4	51.1	52.0
A-Q	<b>All industries</b>	100	100	100	100	100	100

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**Table 15: Volume and use of primary energy in the economic territory, with intermediate goods from the economic territory and abroad**

	Direct	Indirect	Trade	Consumption
1991				
Domestic production	5,641	-	5,641	27.5
+ Imports	10,015	4,825	14,840	72.5
= Supply	15,656	4,825	20,481	100.0
- Intermediate consumption	10,700	-10,700	0	0.0
= Final uses	4,956	15,525	20,481	100.0
- Exports and ocean bunkering	1,199	4,866	8,065	29.6
= Final domestic uses	3,757	10,659	14,416	70.4
Domestic final consumption of private households	3,767	6,626	10,393	50.7
Consumption expenditure of non-profit institutions serving households	-	79	79	0.4
Government final consumption expenditure	-	1,350	1,350	6.6
Gross fixed capital formation	-	2,461	2,461	12.0
Changes in stocks, acquisitions less disposals of valuables	- 10	143	133	0.6
1999				
Domestic production	3,795	-	3,795	17.8
+ Imports	11,336	6,203	17,539	82.2
= Supply	15,131	6,203	21,334	100.0
- Intermediate consumption	9,997	-9,997	0	0.0
= Final uses	5,134	16,200	21,334	100.0
- Exports and ocean bunkering	1,144	6,201	7,345	34.4
= Final domestic uses	3,990	9,999	13,989	65.6
Domestic final consumption of private households	4,227	6,493	10,720	50.3
Consumption expenditure of non-profit institutions serving households	-	92	92	0.4
Government final consumption expenditure	-	1,150	1,150	5.4
Gross fixed capital formation	-	2,301	2,301	10.8
Changes in stocks, acquisitions less disposals of valuables	- 237	- 38	- 275	- 1.3
1999 on 1991, in percent				
Domestic production	- 32.7	0.0	- 32.7	
+ Imports	13.2	28.6	18.2	
= Supply	- 3.4	28.6	4.2	
- Intermediate consumption	- 5.6	- 6.6	0.0	
= Final uses	3.6	4.3	4.2	
- Exports and ocean bunkering	- 4.6	27.4	21.1	
= Final domestic uses	6.2	- 6.2	- 3.0	
Domestic final consumption of private households	12.2	- 2.0	3.1	
Consumption expenditure of non-profit institutions serving households	0.0	16.2	16.2	
Government final consumption expenditure	0.0	- 14.8	- 14.8	
Gross fixed capital formation	0.0	- 6.5	- 6.5	
Changes in stocks, acquisitions less disposals of valuables	2,222.3	- 126.5	- 306.5	
1999 on 1991, absolute				
Domestic production	-1,846	0	-1,846	
+ Imports	1,321	1,378	2,699	
= Supply	-525	1,378	853	
- Intermediate consumption	-703	703	0	
= Final uses	178	675	853	
- Exports and ocean bunkering	-55	1,335	1,280	
= Final domestic uses	233	-661	-427	
Domestic final consumption of private households	460	-133	327	
Consumption expenditure of non-profit institutions serving households	0	13	13	
Government final consumption expenditure	0	-200	-200	
Gross fixed capital formation	0	-159	-159	
Changes in stocks, acquisitions less disposals of valuables	-227	-181	-408	

**Table 16: Domestic direct energy consumption**

Terajoules

WZL	Industry	1990	1991	1992	1993	1994	1995
A-B	Agriculture, forestry and fishing	207,056	159,815	158,981	154,184	147,696	159,126
C-F	Production industries, total	8,497,730	8,082,328	8,181,007	8,160,536	8,148,485	7,588,914
10	Mining of coal and lignite, extraction of peat	283,399	250,941	217,910	179,629	158,163	157,673
13,14	Mining and quarrying, except of energy producing materials	85,027	66,617	60,568	51,026	49,632	61,994
15	Manufacture of food products	264,915	270,576	274,535	267,447	267,203	261,767
17	Manufacture of textiles	47,467	39,726	39,474	37,613	37,677	39,641
20	Manufacture of wood and wood products, except furniture	48,989	45,718	45,679	43,704	45,826	46,794
21	Manufacture of pulp, paper and paper products	196,254	199,691	191,794	196,170	188,112	176,551
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	440,506	454,547	466,489	433,587	448,623	453,674
24	Manufacture of chemicals, chemical products and man-made fibres	1,539,995	1,443,308	1,429,418	1,472,240	1,460,405	1,488,197
25	Manufacture of rubber and plastic products	80,532	78,032	77,223	78,946	78,729	80,367
26	Manufacture of other non-metallic mineral products	316,030	379,050	374,186	376,497	367,342	366,137
27	Manufacture of basic metals	823,077	786,774	763,842	801,501	809,554	694,529
28	Manufacture of fabricated metal products, except machinery and equipment	136,555	120,069	119,852	116,792	118,117	120,551
29	Manufacture of machinery and equipment	140,245	118,196	120,565	111,843	109,194	122,418
31	Manufacture of electrical machinery and apparatus n.e.c.	70,457	59,772	60,281	56,905	57,073	58,977
32	Manufacture of radio, television and communication equipment and apparatus	33,426	29,272	30,309	28,514	28,640	29,367
34	Manufacture of motor vehicles, trailers and semi-trailers	141,602	156,281	167,919	162,855	163,713	169,010
35	Manufacture of other transport equipment	20,309	22,975	25,128	24,394	24,530	25,250
40	Electricity, gas, steam and hot water supply	3,218,793	2,965,983	3,085,786	3,119,159	3,139,908	2,621,136
41	Collection, purification and distribution of water	15,962	19,093	19,682	19,573	19,417	21,915
45	Construction	335,819	295,343	290,653	293,731	294,399	280,267
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	258,370	280,362	319,717	290,410	282,026	312,697
G-Q	<b>Service activities, total</b>	1,995,173	2,080,343	2,226,084	2,139,100	2,172,893	2,248,999
51-52	Commission trade and wholesale trade, retail trade (except of motor vehicles and motorcycles); repair of personal and household goods	381,044	433,317	462,145	442,481	450,622	464,134
60	Land transport; transport via pipelines	293,532	333,134	338,084	344,535	354,754	379,118
62	Air transport	207,273	248,744	256,685	265,815	273,847	292,398
75	Public administration and defence; compulsory social security	366,121	253,080	271,393	254,989	255,366	256,028
50, 59, 61, 63-64 70-74, 80-95	Other service activities	747,202	812,068	897,777	831,279	838,304	857,320
A-Q	<b>All industries</b>	10,699,959	10,322,486	10,566,073	10,453,820	10,469,074	9,997,036
	Domestic final consumption of private households	3,767,056	3,945,619	4,183,667	4,146,783	4,083,973	4,227,021
	<b>All industries and domestic final consumption of private households</b>	14,467,014	14,268,104	14,749,739	14,600,603	14,553,047	14,224,060

**Table 17: Domestic direct specific energy consumption**

Energy consumption per gross value added (prices of 1995)

kJ / DM

A-B	<b>Agriculture, forestry and fishing</b>	5,274.0	3,785.3	3,529.0	3,437.8	3,215.0
C-F	<b>Production industries, total</b>	7,770.5	7,619.3	7,916.4	7,778.5	7,700.6
10	Mining of coal and lignite, extraction of peat	19,109.8	23,149.6	25,047.1	30,189.7	27,845.6
13, 14	Mining and quarrying, except of energy producing materials	15,716.6	10,312.2	10,424.8	9,966.0	9,279.7
15	Manufacture of food products	4,193.7	4,022.8	4,241.9	4,040.0	4,304.9
17	Manufacture of textiles	2,931.8	3,424.6	3,651.6	3,431.8	3,475.7
20	Manufacture of wood and wood products, except furniture	3,519.3	2,658.0	2,715.7	2,526.2	2,760.6
21	Manufacture of pulp, paper and paper products	11,794.1	13,224.6	11,652.1	10,638.3	10,157.3
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	54,383.5	101,235.4	121,798.7	90,142.8	78,705.9
24	Manufacture of chemicals, chemical products and man-made fibres	21,472.3	18,304.5	18,347.0	18,607.7	18,388.4
25	Manufacture of rubber and plastic products	2,330.9	2,163.4	2,215.9	2,035.6	2,003.3
26	Manufacture of other non-metallic mineral products	10,392.3	10,765.4	11,474.6	11,688.8	11,275.1
27	Manufacture of basic metals	26,229.4	25,192.9	24,848.5	25,039.1	25,048.1
28	Manufacture of fabricated metal products, except machinery and equipment	1,970.2	1,761.1	1,863.1	1,783.5	1,756.4
29	Manufacture of machinery and equipment	1,124.0	1,091.1	1,143.1	1,053.0	974.8
31	Manufacture of electrical machinery and apparatus n.e.c.	1,065.3	1,095.7	1,112.6	1,030.5	1,044.3
32	Manufacture of radio, television and communication equipment and apparatus	1,836.6	1,992.7	2,137.5	1,806.9	1,696.7
34	Manufacture of motor vehicles, trailers and semi-trailers	1,471.7	1,799.6	2,045.5	1,835.8	1,760.4
35	Manufacture of other transport equipment	1,264.6	2,245.8	2,122.1	1,768.4	1,722.6
40	Electricity, gas, steam and hot water supply	54,565.1	47,071.6	44,663.3	47,103.0	46,745.7
41	Collection, purification and distribution of water	1,699.9	2,473.2	2,559.4	2,260.2	2,224.2
45	Construction	1,684.3	1,324.3	1,357.6	1,393.1	1,424.1
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	2,043.9	2,551.3	2,982.4	2,669.2	2,585.3
G-Q	<b>Service activities, total</b>	1,005.6	948.9	987.8	929.8	917.4
51-52	Commission trade and wholesale trade, retail trade (except of motor vehicles and motorcycles); repair of personal and household goods	1,367.0	1,424.5	1,521.5	1,469.3	1,475.1
50	Land transport; transport via pipelines	4,680.0	5,768.6	5,748.7	5,978.4	6,172.8
62	Air transport	32,744.6	20,973.3	19,184.2	18,706.2	18,990.8
75	Public administration and defence; compulsory social security	1,726.3	1,158.7	1,234.3	1,188.0	1,173.5
50, 59, 61, 63-64 70-74, 80-95	Other service activities	524.8	507.5	541.6	486.3	472.7
A-Q	<b>All Industries</b>	3,433.0	3,132.4	3,171.0	3,079.6	3,014.7
	Memorandum item: Domestic final consumption of private households <sup>1)</sup>	2,323.0	2,332.2	2,451.2	2,408.1	2,324.1
						2,344.4

1) Energy consumption put in relation to the consumption expenditure of households at constant prices.

**Table 18: Domestic direct specific energy consumption**

Energy consumption per gross value added (prices of 1995)

1991 = 100

		1990	1991	1992	1993	1994	1995
A-B	<b>Agriculture, forestry and fishing</b>	100	71.8	66.9	65.2	61.0	63.5
C-F	<b>Production industries, total</b>	100	98.1	101.9	100.1	99.1	100.5
10	Mining of coal and lignite, extraction of peat	100	121.1	131.1	158.0	145.7	149.7
13-14	Mining and quarrying, except of energy producing materials	100	65.6	66.3	63.4	59.0	73.6
15	Manufacture of food products	100	95.9	101.1	96.3	102.7	97.2
17	Manufacture of textiles	100	116.8	124.6	117.1	118.6	139.0
20	Manufacture of wood and wood products, except furniture	100	75.5	77.2	71.8	78.4	81.2
21	Manufacture of pulp, paper and paper products	100	112.1	98.8	90.2	86.1	77.5
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	100	186.2	224.0	185.8	144.7	314.8
24	Manufacture of chemicals, chemical products and man-made fibres	100	85.2	85.4	86.7	85.6	90.5
25	Manufacture of rubber and plastic products	100	92.8	95.1	87.3	85.9	89.9
26	Manufacture of other non-metallic mineral products	100	103.6	110.4	112.5	108.5	107.1
27	Manufacture of basic metals	100	96.0	94.7	95.5	95.5	81.3
28	Manufacture of fabricated metal products, except machinery and equipment	100	89.4	94.6	91.0	89.1	90.7
29	Manufacture of machinery and equipment	100	97.1	101.7	93.7	86.7	103.5
31	Manufacture of electrical machinery and apparatus n.e.c.	100	102.9	104.4	96.7	98.0	95.6
32	Manufacture of radio, television and communication equipment and apparatus	100	108.5	116.4	98.4	92.4	77.5
34	Manufacture of motor vehicles, trailers and semi-trailers	100	122.3	139.0	124.7	119.6	133.6
35	Manufacture of other transport equipment	100	177.6	167.8	141.4	136.2	116.4
40	Electricity, gas, steam and hot water supply	100	85.3	81.9	86.3	85.7	70.6
41	Collection, purification and distribution of water	100	145.5	150.6	133.0	130.8	145.8
45	Construction	100	79.6	81.6	83.7	85.6	81.7
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	100	124.8	145.9	130.6	126.5	142.5
G-Q	<b>Service activities, total</b>	100	94.4	98.2	92.5	91.2	91.3
51-52	Commission trade and wholesale trade, retail trade (except of motor vehicles and motorcycles); repair of personal and household goods	100	104.2	111.3	107.5	107.9	108.3
60	Land transport; transport via pipelines	100	123.8	123.4	128.3	132.5	131.8
62	Air transport	100	64.1	58.6	57.1	58.0	62.8
75	Public administration and defence; compulsory social security	100	67.1	71.5	67.7	68.0	68.6
50, 59, 61, 63-64 70-74, 80-95	Other service activities	100	96.7	103.2	92.7	90.1	88.7
A-Q	<b>All industries</b>	100	91.2	92.4	89.7	87.8	84.0
	Memorandum item: Domestic final consumption of private households	100	100.4	105.5	103.7	100.0	100.9

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**Table 19: Water flow between nature and economy as well as within the economy**

mn m<sup>3</sup>

	Water withdrawal from nature	Water withdrawal from other industries	Other industries	Private house-holds	Total
<b>1991</b>					
Water withdrawal from nature	6,869	3,354	41,037	83	51,344
Foreign water and rainwater	-	3,354	-	-	3,354
Ground water, surface water, etc.	6,869	-	41,037	83	47,990
+ Water received from other industries	- 5,969	-	2,494	3,467	- 8
= Water use	901	3,354	43,531	3,551	51,336
- Water incorporated into, minus water removed from other materials	-	-	343	- 154	189
= Water discharged into nature	901	3,354	43,188	3,704	51,148
<b>1995</b>					
Water withdrawal from nature	6,448	5,273	37,141	47	48,909
Foreign water and rainwater	-	5,273	-	-	5,273
Ground water, surface water, etc.	6,448	-	37,141	47	43,636
+ Water received from other industries	- 5,613	-	2,340	3,266	- 8
= Water use	835	5,273	39,480	3,313	48,901
- Water incorporated into, minus water removed from other materials	-	-	329	- 152	177
= Water discharged into nature	835	5,273	39,151	3,465	48,724
<b>1998</b>					
Water withdrawal from nature	6,135	4,734	34,587	46	45,502
Foreign water and rainwater	-	4,734	-	-	4,734
Ground water, surface water, etc.	6,135	-	34,587	46	40,768
+ Water received from other industries	- 5,403	-	2,192	3,204	- 7
= Water use	732	4,734	36,779	3,250	45,495
- Water incorporated into, minus water removed from other materials	-	-	320	- 155	164
= Water discharged into nature	732	4,734	36,459	3,405	45,331

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Table 20: Withdrawal of water from, and discharge of water into nature, 1991  
mn m<sup>3</sup>

		Water withdrawn from nature	Water released from nature	Water incorporated into products	Water released from products	Water discharged into nature	Water discharged into nature		
							Other waters	Direct (incl. evaporation and leaching)	Indirect water disposal
A-B	<b>Agriculture, forestry and fishing</b>	1,273	163	1,436	0	304	1,132	33	1,099
10	Mining of coal and lignite, extraction of peat	2,417	209	2,826	0	0	2,526	32	2,594
13, 14	Mining and quarrying, except of energy producing materials	609	7	618	0	0	616	4	612
15	Manufacture of food products	442	172	614	0	38	576	233	343
17	Manufacture of textiles	238	24	262	0	0	262	84	178
20	Manufacture of wood and wood products, except furniture	24	9	33	0	0	33	10	23
21	Manufacture of pulp, paper and paper products	798	27	824	0	0	824	72	753
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	344	34	378	0	0	378	18	360
24	Manufacture of chemicals, chemical products and man-made fibres	3,932	374	4,366	0	0	4,366	178	4,188
25	Manufacture of rubber and plastic products	106	22	128	0	0	128	28	100
26	Manufacture of other non-metallic mineral products	192	37	229	0	0	229	30	199
27	Manufacture of basic metals	1,284	180	1,464	0	0	1,464	102	1,362
28	Manufacture of fabricated metal products, except machinery and equipment	120	38	158	0	0	158	39	118
29	Manufacture of machinery and equipment	99	70	188	0	0	166	76	92
31	Manufacture of electrical machinery and apparatus n.e.c.	19	15	34	0	0	34	16	18
32	Manufacture of radio, television and communication equipment and apparatus	61	27	88	0	0	88	15	73
34	Manufacture of motor vehicles, trailers and semi-trailers	148	24	172	0	0	172	34	139
35	Manufacture of other transport equipment	13	12	25	0	0	25	10	14
11-12, 18, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	84	47	130	0	0	130	46	84
40	Electricity, gas, steam and hot water supply	28,776	347	29,123	0	0	29,123	76	29,047
41	Collection, purification and distribution of water	6,669	-5,969	901	0	0	901	143	758
90 (part)	Waste water disposal	3,354	0	3,354	0	0	3,354	-4,953	8,327
F-O	<b>Construction and service activities 2)</b>	0	656	856	0	0	656	631	26
A-Q	<b>All Industries</b>	51,261	-3,475	47,788	0	343	47,443	-3,075	50,516
	Domestic final consumption of private households	83	3,467	3,551	154	0	3,704	3,075	330
	<b>All Industries and domestic final consumption of private households</b>	51,344	-3	51,336	154	343	51,148	0	51,148

1) Water distributed or supplied by water works or other facilities.

2) Excl. 90 (part) Waste water disposal.

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Table 21: Withdrawal of water from, and discharge of water into nature, 1995  
mn m<sup>3</sup>

		1	2	3	4	5	6	7	8
A-B	<b>Agriculture, forestry and fishing</b>	764	152	917	0	290	627	31	596
10	Mining of coal and lignite, extraction of peat	2,175	114	2,289	0	0	2,289	29	2,280
13 14	Mining and quarrying, except of energy producing materials	660	4	664	0	0	664	7	657
15	Manufacture of food products	321	217	538	0	39	499	239	259
17	Manufacture of textiles	191	19	210	0	0	210	54	156
20	Manufacture of wood and wood products, except furniture	17	4	21	0	0	21	3	17
21	Manufacture of pulp, paper and paper products	683	66	749	0	0	749	99	650
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	253	43	296	0	0	296	38	259
24	Manufacture of chemicals, chemical products and man-made fibres	2,969	435	3,404	0	0	3,404	225	3,179
25	Manufacture of rubber and plastic products	79	21	100	0	0	100	24	77
26	Manufacture of other non-metallic mineral products	149	53	202	0	0	202	34	198
27	Manufacture of basic metals	866	125	992	0	0	992	67	925
28	Manufacture of fabricated metal products, except machinery and equipment	28	24	52	0	0	52	25	27
29	Manufacture of machinery and equipment	37	27	84	0	0	84	30	35
31	Manufacture of electrical machinery and apparatus n.e.c.	15	20	35	0	0	35	20	15
32	Manufacture of radio, television and communication equipment and apparatus	41	12	53	0	0	53	14	39
34	Manufacture of motor vehicles, trailers and semi-trailers	125	25	150	0	0	150	26	124
35	Manufacture of other transport equipment	11	7	18	0	0	18	6	11
11-12, 16, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	53	23	76	0	0	76	23	53
40	Electricity, gas, steam and hot water supply	27,702	332	28,034	0	0	28,034	49	27,985
41	Collection, purification and distribution of water	6,448	-5,613	835	0	0	835	124	711
90 (part)	Waste water disposal	5,273	0	5,273	0	0	5,273	-4,609	9,962
F-Q	<b>Construction and service activities<sup>2)</sup></b>	0	618	618	0	0	618	594	24
A-Q	<b>All industries</b>	48,562	-3,274	45,588	0	329	45,259	-2,930	48,169
	Domestic final consumption of private households	47	3,268	3,313	152	0	3,465	2,930	535
	All industries and domestic final consumption of private households	48,909	-6	48,901	152	329	48,724	0	48,724

1) Water distributed or supplied by water works or other facilities.

2) Excl. 90 (part) Waste water disposal.

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Table 22: Withdrawal of water from, and discharge of water into nature, 1998  
mn m<sup>3</sup>

		Withdrawal of water from nature				Discharge of water into nature			
		Water withdrawal	Water withdrawal	Water withdrawal	Water withdrawal	Water discharge	Water discharge	Water discharge	
A-B	<b>Agriculture, forestry and fishing</b>	309	158	467	0	280	185	30	157
10	Mining of coal and lignite, extraction of peat	2,018	81	2,099	0	0	2,099	16	2,083
13,14	Mining and quarrying, except of energy producing materials	460	2	463	0	0	463	8	454
15	Manufacture of food products	301	154	455	0	39	415	185	230
17	Manufacture of textiles	173	13	185	0	0	155	49	137
20	Manufacture of wood and wood products, except furniture	16	3	19	0	0	19	7	12
21	Manufacture of pulp, paper and paper products	575	25	600	0	0	600	56	544
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	213	25	238	0	0	238	11	227
24	Manufacture of chemicals, chemical products and man-made fibres	2,961	502	3,464	0	0	3,464	307	3,157
25	Manufacture of rubber and plastic products	85	24	109	0	0	109	28	82
26	Manufacture of other non-metallic mineral products	142	25	167	0	0	167	43	124
27	Manufacture of basic metals	761	103	864	0	0	864	71	793
28	Manufacture of fabricated metal products, except machinery and equipment	27	21	48	0	0	48	22	26
29	Manufacture of machinery and equipment	32	15	47	0	0	47	21	26
31	Manufacture of electrical machinery and apparatus n.e.c	14	16	30	0	0	30	12	19
32	Manufacture of radio, television and communication equipment and apparatus	38	10	48	0	0	48	12	38
34	Manufacture of motor vehicles, trailers and semi-trailers	61	28	87	0	0	87	26	60
35	Manufacture of other transport equipment	7	5	13	0	0	13	6	7
11-12, 16 18, 19, 22 30, 33, 36 37	Other branches of mining and manufacturing	21	17	38	0	0	38	20	18
40	Electricity, gas, steam and hot water supply	26,372	359	26,731	0	0	26,731	35	26,696
41	Collection, purification and distribution of water	6,135	-5,403	732	0	0	732	132	600
90 (part)	Waste water disposal	4,734	0	4,734	0	0	4,734	-4,726	9,460
F-O	<b>Construction and service activities<sup>2)</sup></b>	0	606	606	0	0	606	583	24
A-Q	<b>All Industries</b>	45,456	-3,210	42,245	0	320	41,926	-3,047	44,972
	Domestic final consumption of private households	48	3,204	3,250	155	0	3,405	3,047	358
	<b>All industries and domestic final consumption of private households</b>	45,502	-7	45,495	155	320	45,331	0	45,331

1) Water distributed or supplied by water works or other facilities.

2) Excl. 90 (part) Waste water disposal.

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Table 23: Discharge of water into nature, 1991  
min m<sup>3</sup>

Y21		WATER DISCHARGE						WATER CONSUMPTION
		WATER SUPPLY	INDUSTRIAL	DOMESTIC	AGRICULTURE	WATER SUPPLY	INDUSTRIAL	
A-B	<b>Agriculture, forestry and fishing</b>	1,132	33	0	33	0	1,099	0
10	Mining of coal and lignite, extraction of peat	2,626	2,352	2,320	32	0	274	0
13, 14	Mining and quarrying, except of energy producing materials	616	457	454	4	0	159	0
15	Manufacture of food products	576	524	291	233	0	51	0
17	Manufacture of textiles	262	208	124	84	0	53	0
20	Manufacture of wood and wood products, except furniture	33	28	18	10	0	5	0
21	Manufacture of pulp, paper and paper products	824	791	719	72	0	34	0
23	Manufacture of coke, refined petroleum products, manufacture of fertilizer material	378	313	285	18	0	65	0
24	Manufacture of chemicals, chemical products and man-made fibres	4,366	4,325	4,147	178	0	41	0
25	Manufacture of rubber and plastic products	128	119	90	28	0	10	0
26	Manufacture of other non-metallic mineral products	229	183	153	30	0	46	0
27	Manufacture of basic metals	1,464	1,371	1,270	102	0	93	0
28	Manufacture of fabricated metal products, except machinery and equipment	158	111	72	39	0	47	0
29	Manufacture of machinery and equipment	168	141	65	76	0	27	0
31	Manufacture of electrical machinery and apparatus n.e.c.	34	32	16	16	0	2	0
32	Manufacture of radio, television and communication equipment and apparatus	88	51	36	15	0	37	0
34	Manufacture of motor vehicles, trailers and semi-trailers	172	167	133	34	0	5	0
35	Manufacture of other transport equipment	25	22	11	10	0	3	0
11-12, 15, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	130	100	54	46	0	31	0
40	Electricity, gas, steam and hot water supply	29,123	28,461	28,385	76	0	662	0
41	Collection, purification and distribution of water	801	143	0	143	758	0	0
90 (part)	Waste water disposal	3,354	0	0	0	0	0	3,354
F-O	<b>Construction and service activities<sup>1)</sup></b>	656	631	0	631	0	26	0
A-Q	<b>All industries</b>	47,443	40,562	38,654	1,908	758	2,769	3,354
	Domestic final consumption of private households	3,704	3,409	304	3,075	0	296	0
	<b>All industries and domestic final consumption of private households</b>	51,148	43,971	38,968	4,983	758	3,065	3,354

1) Excl. 90 (part) Waste water disposal

Table 24: Discharge of water into nature, 1995  
mn. m<sup>3</sup>

		Total	Industry	Agriculture	Domestic	Evaporation	Discharge into nature
A-B	<b>Agriculture, forestry and fishing</b>	627	31	0	31	0	596
10	Mining of coal and lignite, extraction of peat	2,289	2,181	2,152	29	0	108
13,14	Mining and quarrying, except of energy producing materials	664	633	626	7	0	31
15	Manufacture of food products	499	469	230	239	0	29
17	Manufacture of textiles	210	199	145	54	0	11
20	Manufacture of wood and wood products, except furniture	21	18	14	3	0	3
21	Manufacture of pulp, paper and paper products	749	717	618	99	0	32
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	296	229	193	36	0	67
24	Manufacture of chemicals, chemical products and man-made fibres	3,404	3,356	3,131	225	0	48
25	Manufacture of rubber and plastic products	100	91	68	24	0	9
26	Manufacture of other non metallic mineral products	202	147	113	34	0	55
27	Manufacture of basic metals	992	924	857	67	0	68
28	Manufacture of fabricated metal products, except machinery and equipment	52	48	22	25	0	5
29	Manufacture of machinery and equipment	64	58	30	30	0	5
31	Manufacture of electrical machinery and apparatus n.e.c.	35	32	12	20	0	3
32	Manufacture of radio, television and communication equipment and apparatus	53	52	38	14	0	1
34	Manufacture of motor vehicles, trailers and semi-trailers	150	138	112	26	0	12
35	Manufacture of other transport equipment	18	17	10	6	0	1
11-12, 16, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	76	40	17	23	0	36
40	Electricity, gas, steam and hot water supply	28,034	27,482	27,413	49	0	572
41	Collection, purification and distribution of water	835	124	0	124	711	0
90 (part)	Waste water disposal	5,273	0	0	0	0	5,273
F-O	<b>Construction and service activities 1)</b>	618	594	0	594	0	24
A-Q	<b>All industries</b>	45,259	37,560	35,801	1,759	711	1,715
	Domestic final consumption of private households	3,465	3,180	250	2,930	0	285
	<b>All industries and domestic final consumption of private households</b>	48,724	40,740	36,051	4,689	711	2,000
							5,273

1) Excl. 90 (part) Waste water disposal

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**Table 26: Waste water directly discharged, 1991**

mn m<sup>3</sup>

Industry	Activity	without treatment			
		Industrial waste water	Domestic waste water	Cooling water	Other waste water
A-B	<b>Agriculture, forestry and fishing</b>	0	0	0	0
10	Mining of coal and lignite, extraction of peat	2,320	175	2,144	912
13,14	Mining and quarrying, except of energy producing materials	454	30	423	120
15	Manufacture of food products	291	63	229	186
17	Manufacture of textiles	124	12	113	112
20	Manufacture of wood and wood products, except furniture	18	0	18	14
21	Manufacture of pulp, paper and paper products	719	253	466	386
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	295	66	229	194
24	Manufacture of chemicals, chemical products and man-made fibres	4,147	681	3,466	3,092
25	Manufacture of rubber and plastic products	90	10	80	77
26	Manufacture of other non-metallic mineral products	153	14	139	42
27	Manufacture of basic metals	1,270	454	816	743
28	Manufacture of fabricated metal products, except machinery and equipment	72	4	68	27
29	Manufacture of machinery and equipment	65	8	57	48
31	Manufacture of electrical machinery and apparatus n.e.c.	16	2	14	13
32	Manufacture of radio, television and communication equipment and apparatus	36	1	35	35
34	Manufacture of motor vehicles, trailers and semi-trailers	133	9	124	117
35	Manufacture of other transport equipment	11	2	10	7
11-12, 16, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	54	5	49	26
40	Electricity, gas, steam and hot water supply	28,385	57	28,328	28,282
41	Collection, purification and distribution of water	0	0	0	0
90 (part)	Waste water disposal	0	0	0	0
F-O	<b>Construction and service activities<sup>1)</sup></b>	0	0	0	0
A-Q	<b>All Industries</b>	38,654	1,846	36,808	34,433
	Domestic final consumption of private households	334	334	0	0
	<b>All industries and domestic final consumption of private households</b>	38,988	2,180	36,808	34,433
					2,375

1) Excl. 90 (part) Waste water disposal.

**Table 27: Waste water directly discharged, 1995**  
mn m<sup>3</sup>

	Activity	Total	With treatment	without treatment		
				Total discharge	Cooling water waste	other waste
<b>A-B</b>	<b>Agriculture, forestry and fishing</b>	0	0	0	0	0
10	Mining of coal and lignite, extraction of peat	2,152	65	2,087	736	1,351
13, 14	Mining and quarrying, except of energy producing materials	626	21	605	76	529
15	Manufacture of food products	230	57	173	143	30
17	Manufacture of textiles	145	3	141	140	1
20	Manufacture of wood and wood products, except furniture	14	0	14	11	3
21	Manufacture of pulp, paper and paper products	618	227	391	386	6
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	193	81	112	100	12
24	Manufacture of chemicals, chemical products and man-made fibres	3,131	514	2,617	2,377	240
25	Manufacture of rubber and plastic products	68	7	61	60	1
26	Manufacture of other non-metallic mineral products	113	11	103	24	79
27	Manufacture of basic metals	857	231	626	578	49
28	Manufacture of fabricated metal products, except machinery and equipment	22	2	20	19	1
29	Manufacture of machinery and equipment	30	1	28	21	7
31	Manufacture of electrical machinery and apparatus n.e.c.	12	1	11	10	1
32	Manufacture of radio, television and communication equipment and apparatus	38	1	36	37	0
34	Manufacture of motor vehicles, trailers and semi-trailers	112	9	102	99	3
35	Manufacture of other transport equipment	10	1	10	6	4
11-12, 16, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	17	2	14	10	4
40	Electricity, gas, steam and hot water supply	27,413	39	27,374	27,326	48
41	Collection, purification and distribution of water	0	0	0	0	0
90 (part)	Waste water disposal	0	0	0	0	0
<b>F-O</b>	<b>Construction and service activities<sup>1)</sup></b>	0	0	0	0	0
<b>A-Q</b>	<b>All Industries</b>	35,801	1,273	34,528	32,159	2,369
	Domestic final consumption of private households	250	250	0	0	0
	<b>All Industries and domestic final consumption of private households</b>	36,051	1,523	34,528	32,159	2,369

1) Excl. 90 (part) Waste water disposal.

**Table 28: Waste water directly discharged, 1998**  
mn m<sup>3</sup>

W297 code	Industries	Total discharge	with treatment	without treatment		
				total	cooling waste water	other waste water
A-B	<b>Agriculture, forestry and fishing</b>	0	0	0	0	0
10	Mining of coal and lignite, extraction of peat	2,011	38	1,973	729	1,244
13, 14	Mining and quarrying, except of energy producing materials	375	11	365	17	348
15	Manufacture of food products	221	52	169	153	16
17	Manufacture of textiles	135	4	131	130	1
20	Manufacture of wood and wood products, except furniture	12	0	12	10	2
21	Manufacture of pulp, paper and paper products	484	225	259	257	1
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	193	33	160	152	8
24	Manufacture of chemicals, chemical products and man-made fibres	3,153	488	2,664	2,454	211
25	Manufacture of rubber and plastic products	75	5	70	69	1
26	Manufacture of other non-metallic mineral products	114	6	108	17	91
27	Manufacture of basic metals	728	64	664	628	35
28	Manufacture of fabricated metal products, except machinery and equipment	22	2	21	18	3
29	Manufacture of machinery and equipment	26	1	25	17	8
31	Manufacture of electrical machinery and apparatus n.e.c.	19	1	19	17	2
32	Manufacture of radio, television and communication equipment and apparatus	34	0	34	34	0
34	Manufacture of motor vehicles, trailers and semi-trailers	51	9	43	37	5
35	Manufacture of other transport equipment	7	0	7	5	2
11-12, 15, 18-19, 22, 30, 33, 36- 37	Other branches of mining and manufacturing	14	1	13	10	3
40	Electricity, gas, steam and hot water supply	25,948	83	25,863	25,842	20
41	Collection, purification and distribution of water	0	0	0	0	0
90 (part)	Waste water disposal	0	0	0	0	0
F-O	<b>Construction and service activities<sup>1)</sup></b>	0	0	0	0	0
A-Q	<b>All economic sectors</b>	33,623	1,024	32,599	30,596	2,003
	Domestic final consumption of private households	207	207	0	0	0
	<b>All industries and domestic final consumption of private households</b>	33,830	1,231	32,599	30,596	2,003

1) Excl. 90 (part) Waste water disposal.

**Table 29: Specific water use, 1991, 1995 and 1998**

Water use per gross value added (prices of 1995)  
m<sup>3</sup> per DM 1 000

	Industries	1991	1995	1998
A-B	<b>Agriculture, forestry and fishing</b>	36.6	21.7	10.2
10	Mining of coal and lignite, extraction of peat	177.1	211.1	369.6
13, 14	Mining and quarrying, except of energy producing materials	113.9	102.8	86.2
15	Manufacture of food products	9.7	8.0	7.3
17	Manufacture of textiles	16.2	16.1	17.1
20	Manufacture of wood and wood products, except furniture	2.4	1.2	1.2
21	Manufacture of pulp, paper and paper products	49.5	49.6	32.4
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	46.7	65.9	41.7
24	Manufacture of chemicals, chemical products and man-made fibres	60.9	43.2	43.6
25	Manufacture of rubber and plastic products	3.7	2.8	2.8
26	Manufacture of other non-metallic mineral products	7.5	5.7	5.1
27	Manufacture of basic metals	46.7	31.8	26.7
28	Manufacture of fabricated metal products, except machinery and equipment	2.3	0.8	0.7
29	Manufacture of machinery and equipment	1.4	0.6	0.4
31	Manufacture of electrical machinery and apparatus n.e.c.	0.5	0.6	0.6
32	Manufacture of radio, television and communication equipment and apparatus	4.8	3.6	2.9
34	Manufacture of motor vehicles, trailers and semi-trailers	1.8	1.7	0.8
35	Manufacture of other transport equipment	1.5	1.7	0.9
11-12, 16, 18-19, 22, 30, 33, 36-37	Other branches of mining and manufacturing	1.1	0.7	0.3
40	Electricity, gas, steam and hot water supply	493.7	444.9	398.0
41	Collection, purification and distribution of water	95.9	108.2	83.9
90 (part)	Waste water disposal	968.1	4,272.5	4,045.2
F-O	<b>Construction and service activities 1)</b>	0.3	0.3	0.2
A-Q	<b>All industries</b>	15.3	13.8	12.2

1) Excl. 90 (part) Waste water disposal.

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**Table 30: Treated waste water by types of treatment**

		Year	which			COPART
			without treatment	with chemical-physical treatment	with biological treatment	
Direct discharge	1991	2,180	34	16	50	
	1995	1,523	25	24	51	
	1998	1,231	10	21	69	
Indirect discharge	1991	4,983	8	35	57	
	1995	4,689	4	12	84	
	1998	4,726	1	5	94	
Total	1991	7,163	16	29	55	
	1995	6,212	9	15	76	
	1998	5,957	3	8	89	

1) Including chemical-physical treatment.

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**Table 31: European comparison**  
**Water withdrawal and per capita consumption, 1995 and 1998**

Country	Water withdrawal		Inhabitants		Per capita consumption		Population	
	1995	1998	1995	1998	1995	1998	1995	1998
	km³	km³	1,000	1,000	litres	litres	1,000	1,000
Belgium	8,145.0	7,443.0	10,130.6	10,191.3	804.0	730.3	1998	32
Denmark	887.0	754.0	5,215.7	5,294.9	170.1	142.4	.	.
Germany	42,601.1	40,591.0	81,583.6	82,057.4	522.2	494.7	.	.
Spain	33,288.0	40,855.0	39,177.4	39,347.9	849.7	1,038.3	1995	17,080
France	40,671.6 <sup>2)</sup>	30,341.0	58,020.4	58,722.6	701.0	516.7	.	.
Luxembourg	57.0	61.0	406.6	423.7	140.2	144.0	.	.
Austria	3,368.0	3,561.0	8,039.9	8,075.0	418.9	441.0	.	.
Portugal	.	11,090.0	9,912.1	9,957.3	.	1,113.8	.	.
Finland	2,488.0 <sup>2)</sup>	2,328.0	5,098.8	5,147.3	488.0	452.3	1999	5,414
United Kingdom	12,116.0	15,256.0	58,503.6	59,083.6	207.1	258.2	1998	7,699

1) Excl. seawater and brackish water and excl. foreign water and rainwater.

2) 1994.

Sources: Eurostat, Maria Pau Vall, Ressourcen, Einnahme und Verwendung von Wasser in den europäischen Ländern, in Statistik kurzgefasst- 6/2001- Thema 8;

Federal Statistical Office of Germany, Statistisches Jahrbuch für das Ausland 1997,1999

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Table 32: Cumulated domestic CO<sub>2</sub> emissions with intermediate goods from the economic territory and from the rest of the world

**Table 33: Direct domestic CO<sub>2</sub> emissions**  
1000 tonnes

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
A-B	Agriculture, forestry and fishing	14,853	12,135	11,681	10,655	10,446	10,053	9,592	9,053	9,653	
C-F	Production Industries, total	635,028	598,533	573,924	572,544	566,375	564,988	547,061	543,874	527,094	
10	Mining of coal and lignite, extraction of peat	24,697	22,849	22,555	22,472	27,786	22,203	17,738	15,593	14,690	
13, 14	Mining and quarrying, except of energy producing materials	10,632	10,099	9,267	9,804	9,829	8,857	8,613	8,439	9,111	
15	Manufacture of food products	14,373	14,283	13,841	13,667	14,134	14,275	13,740	13,618	12,989	
17	Manufacture of textiles	2,106	1,611	1,408	1,311	1,383	1,347	1,196	1,196	1,185	
20	Manufacture of wood and wood products, except furniture	2,254	1,851	1,697	1,596	1,673	1,654	1,489	1,471	1,456	
21	Manufacture of pulp, paper and paper products	10,299	10,298	10,444	10,718	10,054	9,479	9,589	8,801	7,558	
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	35,869	30,583	28,190	28,418	25,424	25,785	24,147	25,225	26,253	
24	Manufacture of chemicals, chemical products and man-made fibres	43,876	42,228	39,522	39,309	33,400	32,354	31,862	27,237	27,618	
25	Manufacture of rubber and plastic products	2,312	2,311	1,932	1,850	1,859	1,945	1,830	1,817	1,783	
26	Manufacture of other non-metallic mineral products	34,778	34,710	35,789	37,162	39,569	37,911	38,458	38,202	38,074	
27	Manufacture of basic metals	65,571	60,595	56,359	61,261	65,964	62,800	67,145	67,488	59,639	
28	Manufacture of fabricated metal products, except machinery and equipment	5,456	4,946	4,451	4,162	4,543	4,434	4,105	4,097	4,014	
29	Manufacture of machinery and equipment	5,976	5,421	4,469	4,004	4,395	4,512	4,063	3,886	4,397	
31	Manufacture of electrical machinery and apparatus n.e.c.	3,366	2,715	2,472	2,325	2,405	2,397	2,116	2,120	2,050	
32	Manufacture of radio, television and communication equipment and apparatus	1,890	1,409	1,306	1,240	1,324	1,355	1,203	1,205	1,166	
34	Manufacture of motor vehicles, trailers and semi-trailers	5,733	5,424	5,466	5,056	5,723	6,340	5,756	5,558	5,742	
35	Manufacture of other transport equipment	870	839	855	805	925	1,029	942	919	930	
40	Electricity, gas, steam and hot water supply	341,268	323,491	313,750	310,807	297,215	307,254	295,380	299,646	290,893	
41	Collection, purification and distribution of water	194	201	207	205	213	227	200	206	203	
45	Construction	16,091	13,080	12,625	11,519	11,194	11,095	10,507	10,088	10,361	
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	8,615	7,489	7,310	6,852	7,262	7,738	6,981	7,061	6,983	
G-Q	Service activities, total	106,745	106,529	107,489	105,160	110,198	116,372	108,619	111,160	110,459	
51-52	Wholesale trade and commission trade, retail trade (except of motor vehicles); repair of personal and household goods	21,701	22,640	23,496	23,457	24,795	26,026	24,264	24,898	24,814	
60	Land transport, transport via pipelines	18,035	18,863	19,630	19,941	20,546	20,526	21,198	22,071	23,331	
82	Air transport	11,923	12,747	13,512	13,619	14,190	14,596	15,105	15,606	16,874	
75	Public administration and defence; compulsory social security	18,724	15,725	13,598	11,844	11,490	12,189	10,766	10,780	9,811	
50, 59, 61, 63-67, 70-74, 80-95	Other service activities	36,362	36,554	37,253	36,298	39,177	43,034	37,286	37,807	35,630	
A-Q	All industries	756,826	715,197	693,094	688,368	687,021	691,412	665,273	664,088	647,206	
	Domestic final consumption of private households	219,173	212,092	223,590	214,116	216,144	232,479	227,470	223,375	210,684	
	All industries and final consumption of private households (VGR-Konzept)	975,799	927,289	916,685	902,474	903,165	923,891	892,743	887,464	857,890	
	Balance <sup>1)</sup>	- 601	- 311	- 915	- 1,526	- 993	- 709	- 857	- 736	- 710	
	All industries and final consumption of private households (territorial concept)	976,400	927,600	917,600	904,000	904,158	924,600	893,600	888,200	858,600	

1) Emissions produced by resident production units in the rest of the world minus emissions of non-resident production units in the economic territory.

**Table 34: Direct domestic CO<sub>2</sub> emissions**  
1991 = 100

		1991	1992	1993	1994	1995	1996
A-B	<b>Agriculture, forestry and fishing</b>	100	70.3	67.7	54.6	61.0	65.0
C-F	<b>Production industries, total</b>	100	89.2	89.0	86.1	85.6	83.0
10.	Mining of coal and lignite, extraction of peat	100	112.5	89.9	71.8	63.1	59.5
13, 14	Mining and quarrying, except of energy producing materials	100	92.4	83.3	81.0	79.4	85.7
15	Manufacture of food products	100	98.3	99.3	95.6	94.7	90.4
17	Manufacture of textiles	100	65.7	63.9	56.8	56.8	56.3
20	Manufacture of wood and wood products, except furniture	100	74.2	73.4	66.1	65.2	64.6
21	Manufacture of pulp, paper and paper products	100	97.6	92.0	93.1	85.5	73.4
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	100	70.9	71.9	67.3	70.3	73.2
24	Manufacture of chemicals, chemical products and man-made fibres	100	76.1	73.7	72.6	62.1	62.9
25	Manufacture of rubber and plastic products	100	84.7	84.1	79.1	78.6	77.1
26	Manufacture of other non-metallic mineral products	100	113.8	109.0	110.6	109.8	109.5
27	Manufacture of basic metals	100	100.6	95.8	102.4	102.9	91.0
28	Manufacture of fabricated metal products, except machinery and equipment	100	83.3	81.3	75.2	75.1	73.6
29	Manufacture of machinery and equipment	100	73.5	75.5	68.0	65.0	73.6
31	Manufacture of electrical machinery and apparatus n.e.c.	100	71.4	71.2	62.9	63.0	60.9
32	Manufacture of radio, television and communication equipment and apparatus	100	78.4	80.2	71.2	71.3	69.0
34	Manufacture of motor vehicles, trailers and semi-trailers	100	99.8	110.6	100.4	96.9	100.1
35	Manufacture of other transport equipment	100	106.3	118.3	108.3	105.6	106.9
40	Electricity, gas, steam and hot water supply	100	87.1	90.0	86.6	87.8	85.2
41	Collection, purification and distribution of water	100	110.0	116.9	102.9	106.4	104.4
45	Construction	100	74.2	73.5	69.6	66.8	68.7
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	100	84.3	89.8	81.0	82.0	81.1
G-Q	<b>Service activities, total</b>	100	103.2	109.0	101.8	104.1	103.5
51-52	Wholesale trade and commission trade, retail trade (except of motor vehicles); repair of personal and household goods	100	114.3	119.9	111.8	114.7	114.3
56	Land transport, transport via pipelines	100	113.9	113.8	117.5	122.4	129.4
62	Air transport	100	119.0	122.4	126.7	130.9	141.5
75	Public administration and defence; compulsory social security	100	61.4	65.1	57.5	57.6	52.4
50, 59, 61, 83-87, 70-74, 80-95	Other service activities	100	107.7	118.3	102.5	104.0	98.0
A-Q	<b>All Industries</b>	100	90.8	91.4	87.9	87.8	85.5
	Domestic final consumption of private households	100	98.6	106.1	103.8	101.9	96.1
	<b>All Industries and domestic final consumption of private households</b>	100	92.6	94.7	91.5	90.9	87.9

**Table 35: Direct domestic CO<sub>2</sub> emissions**  
Percent

		1990	1991	1992	1993	1994	1995
A-B	<b>Agriculture, forestry and fishing</b>	1.5	1.2	1.1	1.1	1.0	1.1
C-F	<b>Production industries, total</b>	65.1	62.7	61.2	61.3	61.3	61.4
10	Mining of coal and lignite, extraction of peat	2.5	3.1	2.4	2.0	1.8	1.7
13, 14	Mining and quarrying, except of energy producing materials	1.1	1.1	1.0	1.0	1.0	1.1
15	Manufacture of food products	1.5	1.6	1.5	1.5	1.5	1.5
17	Manufacture of textiles	0.2	0.2	0.1	0.1	0.1	0.1
20	Manufacture of wood and wood products, except furniture	0.2	0.2	0.2	0.2	0.2	0.2
21	Manufacture of pulp, paper and paper products	1.1	1.1	1.0	1.1	1.0	0.9
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	3.7	2.8	2.8	2.7	2.8	3.1
24	Manufacture of chemicals, chemical products and man-made fibres	4.5	3.7	3.5	3.6	3.1	3.2
25	Manufacture of rubber and plastic products	0.2	0.2	0.2	0.2	0.2	0.2
26	Manufacture of other non-metallic mineral products	3.6	4.4	4.1	4.3	4.3	4.4
27	Manufacture of basic metals	6.7	7.3	6.8	7.5	7.6	7.0
28	Manufacture of fabricated metal products, except machinery and equipment	0.6	0.5	0.5	0.5	0.5	0.5
29	Manufacture of machinery and equipment	0.6	0.5	0.5	0.5	0.4	0.5
31	Manufacture of electrical machinery and apparatus n.e.c.	0.3	0.3	0.3	0.2	0.2	0.2
32	Manufacture of radio, television and communication equipment and apparatus	0.2	0.1	0.1	0.1	0.1	0.1
34	Manufacture of motor vehicles, trailers and semi-trailers	0.6	0.6	0.7	0.6	0.6	0.7
35	Manufacture of other transport equipment	0.1	0.1	0.1	0.1	0.1	0.1
40	Electricity, gas, steam and hot water supply	35.0	32.9	33.3	33.1	33.8	33.9
41	Collection, purification and distribution of water	0.0	0.0	0.0	0.0	0.0	0.0
45	Construction	1.5	1.2	1.2	1.2	1.1	1.2
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	0.9	0.8	0.8	0.8	0.8	0.8
G-Q	<b>Service activities, total</b>	10.9	12.2	12.6	12.2	12.5	12.9
51-52	Wholesale trade and commission trade, retail trade (except of motor vehicles); repair of personal and household goods	2.2	2.7	2.8	2.7	2.8	2.9
60	Land transport, transport via pipelines	1.8	2.3	2.2	2.4	2.5	2.7
62	Air transport	1.2	1.6	1.6	1.7	1.8	2.0
75	Public administration and defence; compulsory social security	1.9	1.3	1.3	1.2	1.2	1.1
50, 59, 61, 63-67, 70-74, 80-95	Other service activities	3.7	4.3	4.7	4.2	4.3	4.2
A-Q	<b>All Industries</b>	77.5	76.1	74.8	74.5	74.8	75.4
	Domestic final consumption of private households	22.5	23.9	25.2	25.5	25.2	24.6
	<b>All industries and domestic final consumption of private households</b>	100	100	100	100	100	100

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**Table 36: Direct domestic specific CO<sub>2</sub> emissions**

CO<sub>2</sub> emissions per gross value added (prices of 1995)

Kilogram / EUR 1,000

		1991	1992	1993	1994	1995	1996
A-B	<b>Agriculture, forestry and fishing</b>	378	247	223	214	197	203
C-F	<b>Production industries, total</b>	581	534	547	521	514	504
10	Mining of coal and lignite, extraction of peat	1,665	2,563	2,562	2,981	2,745	2,666
13, 14	Mining and quarrying, except of energy producing materials	1,965	1,522	1,524	1,682	1,571	1,700
15	Manufacture of food products	228	210	221	208	219	202
17	Manufacture of textiles	130	119	125	109	110	122
20	Manufacture of wood and wood products, except furniture	162	97	98	86	89	89
21	Manufacture of pulp, paper and paper products	619	666	576	520	475	391
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	4,428	5,662	6,732	5,020	4,425	9,907
24	Manufacture of chemicals, chemical products and man-made fibres	612	424	415	403	343	361
25	Manufacture of rubber and plastic products	67	54	56	48	46	46
26	Manufacture of other non-metallic mineral products	1,144	1,124	1,163	1,194	1,173	1,157
27	Manufacture of basic metals	2,090	2,112	2,043	2,098	2,088	1,831
28	Manufacture of fabricated metal products, except machinery and equipment	79	67	69	63	61	59
29	Manufacture of machinery and equipment	48	41	43	38	35	42
31	Manufacture of electrical machinery and apparatus n.e.c.	51	44	44	38	39	35
32	Manufacture of radio, television and communication equipment and apparatus	93	90	96	76	71	57
34	Manufacture of motor vehicles, trailers and semi-trailers	60	66	77	65	60	67
35	Manufacture of other transport equipment	54	90	87	69	65	54
40	Electricity, gas, steam and hot water supply	5,785	4,717	4,447	4,461	4,461	4,386
41	Collection, purification and distribution of water	21	28	29	23	24	23
45	Construction	75	50	52	50	49	50
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	68	66	72	64	65	65
G-Q	<b>Service activities, total</b>	54	50	52	47	47	45
51-52	Wholesale trade and commission trade, retail trade (except of motor vehicles); repair of personal and household goods	78	82	86	81	82	79
60	Road transport, transport via pipelines	286	356	349	358	384	378
62	Air transport	1,884	1,196	1,091	1,063	1,082	1,187
75	Public administration and defence; compulsory social security	88	53	55	49	50	45
50, 59, 61, 63-67, 70-74, 80-95	Other service activities	26	24	26	22	21	19
A-Q	<b>All industries</b>	243	208	208	196	191	183
	Memo item: Domestic final consumption of private households	135	128	136	132	127	117

**Table 37: Direct domestic specific CO<sub>2</sub> emissions**  
CO<sub>2</sub> emissions per gross value added (prices of 1995)  
1991 = 100

		1991	1992	1993	1994	1995	1996
A-B	<b>Agriculture, forestry and fishing</b>	100	65.4	59.0	56.5	52.1	53.7
C-F	<b>Production industries, total</b>	100	91.9	94.2	89.8	88.5	86.7
10	Mining of coal and lignite, extraction of peat	100	153.9	153.2	179.0	164.8	160.1
13, 14	Mining and quarrying, except of energy producing materials	100	77.4	77.6	85.6	80.0	86.5
15	Manufacture of food products	100	92.4	96.9	91.2	96.4	88.9
17	Manufacture of textiles	100	91.7	95.8	83.9	84.8	93.7
20	Manufacture of wood and wood products, except furniture	100	60.1	60.7	53.2	54.7	54.9
21	Manufacture of pulp, paper and paper products	100	107.6	93.0	84.0	76.8	63.2
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	100	127.9	152.0	113.4	99.9	223.7
24	Manufacture of chemicals, chemical products and man-made fibres	100	69.2	57.9	65.8	56.1	59.0
25	Manufacture of rubber and plastic products	100	81.2	83.4	72.3	69.1	69.5
26	Manufacture of other non-metallic mineral products	100	98.3	101.7	104.4	102.5	101.2
27	Manufacture of basic metals	100	101.1	97.8	100.4	99.9	87.8
28	Manufacture of fabricated metal products, except machinery and equipment	100	84.6	87.6	80.1	77.4	75.6
29	Manufacture of machinery and equipment	100	84.7	89.3	79.9	72.4	87.3
31	Manufacture of electrical machinery and apparatus n.e.c.	100	86.6	86.9	75.3	76.2	69.5
32	Manufacture of radio, television and communication equipment and apparatus	100	97.1	102.9	82.1	76.9	60.9
34	Manufacture of motor vehicles, trailers and semi-trailers	100	110.6	129.6	108.9	100.3	112.1
35	Manufacture of other transport equipment	100	166.9	160.4	127.5	119.1	100.1
40	Electricity, gas, steam and hot water supply	100	81.5	76.9	77.1	77.1	75.8
41	Collection, purification and distribution of water	100	133.8	142.7	111.6	114.4	110.9
45	Construction	100	67.1	69.3	66.6	65.2	67.2
11-12, 16, 18-19, 22, 30, 33, 36-37	Other production industries	100	97.0	105.9	94.1	95.0	95.4
G-Q	<b>Service activities, total</b>	100	93.4	96.0	87.8	87.2	83.9
51-52	Wholesale trade and commission trade, retail trade (except of motor vehicles); repair of personal and household goods	100	104.7	110.1	103.5	104.7	101.6
60	Land transport, transport via pipelines	100	124.3	121.9	128.5	134.1	132.0
62	Air transport	100	63.5	57.9	56.4	57.5	63.0
75	Public administration and defence; compulsory social security	100	59.6	62.8	55.9	56.1	51.4
50, 59, 61, 63-67, 70-74, 80-95	Other service activities	100	95.9	101.6	85.4	83.5	75.7
A-Q	<b>All industries</b>	100	85.9	85.5	80.7	78.8	75.3
	<b>Memo item:</b> <b>Domestic final consumption of private households</b>	100	94.6	100.8	97.7	94.1	86.5

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**Table 37: Direct domestic specific CO<sub>2</sub> emissions**  
CO<sub>2</sub> emissions per gross value added (prices of 1995)  
1991 = 100

		1991	1992	1993	1994	1995	1996
A-B	<b>Agriculture, forestry and fishing</b>	100	65.4	59.0	56.5	52.1	53.7
C-F	<b>Production industries, total</b>	100	91.9	94.2	89.8	86.5	86.7
10	Mining of coal and lignite, extraction of peat	100	153.9	153.2	179.0	164.8	160.1
13, 14	Mining and quarrying, except of energy producing materials	100	77.4	77.6	85.6	80.0	86.5
15	Manufacture of food products	100	92.4	96.9	91.2	96.4	88.9
17	Manufacture of textiles	100	91.7	95.8	83.9	84.8	93.7
20	Manufacture of wood and wood products, except furniture	100	60.1	60.7	53.2	54.7	54.9
21	Manufacture of pulp, paper and paper products	100	107.6	93.0	84.0	76.8	63.2
23	Manufacture of coke, refined petroleum products, manufacture of fertile material	100	127.9	152.0	113.4	99.9	223.7
24	Manufacture of chemicals, chemical products and man-made fibres	100	69.2	67.9	65.8	56.1	59.0
25	Manufacture of rubber and plastic products	100	81.2	83.4	72.3	69.1	69.5
26	Manufacture of other non-metallic mineral products	100	98.3	101.7	104.4	102.5	101.2
27	Manufacture of basic metals	100	101.1	97.8	100.4	99.9	87.6
28	Manufacture of fabricated metal products, except machinery and equipment	100	84.6	87.6	80.1	77.4	75.6
29	Manufacture of machinery and equipment	100	84.7	89.3	79.9	72.4	87.3
31	Manufacture of electrical machinery and apparatus n.e.c.	100	86.6	86.9	75.3	76.2	69.5
32	Manufacture of radio, television and communication equipment and apparatus	100	97.1	102.9	82.1	76.9	60.9
34	Manufacture of motor vehicles, trailers and semi-trailers	100	110.6	129.6	108.9	100.3	112.1
35	Manufacture of other transport equipment	100	166.9	160.4	127.5	119.1	100.1
40	Electricity, gas, steam and hot water supply	100	81.5	76.9	77.1	77.1	75.8
41	Collection, purification and distribution of water	100	133.8	142.7	111.6	114.4	110.9
45	Construction	100	67.1	69.3	66.6	65.2	67.2
11-12, 18, 18-19, 22, 30, 33, 36-37	Other production industries	100	97.0	105.9	94.1	95.0	95.4
G-Q	<b>Service activities, total</b>	100	93.4	96.0	87.8	87.2	83.9
51-52	Wholesale trade and commission trade, retail trade (except of motor vehicles); repair of personal and household goods	100	104.7	110.1	103.5	104.7	101.6
60	Land transport, transport via pipelines	100	124.3	121.9	128.5	134.1	132.0
62	Air transport	100	63.5	57.9	56.4	57.5	63.0
75	Public administration and defence; compulsory social security	100	59.6	62.8	55.9	56.1	51.4
50, 59, 61, 63-67, 70-74, 80-85	Other service activities	100	95.9	101.6	85.4	83.5	75.7
A-Q	<b>All Industries</b>	100	85.9	85.5	80.7	78.8	75.3
	<b>Memo item:</b> <b>Domestic final consumption of private households</b>	100	94.6	100.8	97.7	94.1	86.5

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Table 38: Domestic cumulated CO<sub>2</sub> emissions of final uses by product groups

Product group	Code	Description	Sums				Exports		Imports		Change (%)			
			1990	1991	1992	1993	1994	1995	1996	1997				
A-D	Products of agriculture, forestry and fishing		16,462	6,528	-48.4	11,111	6,977	-37.2	5,958	2,175	-63.5	5,561	3,621	-34.9
C-E	Products of production industries, total		949,672	892,907	-6.0	535,095	483,159	-9.7	25,639	274,359	5.0	211,222	226,745	7.3
10	Coal and lignite; peat		19,783	7,106	-64.1	18,795	6,688	-64.4	550	164	-70.2	305	293	-4.0
13-14	Metal ores, other mining and quarrying products		2,450	1,790	-26.9	146	114	-21.6	2,486	1,478	-40.0	233	336	31.3
15	Food products and beverages		60,710	51,848	-14.6	51,302	40,176	-21.7	9,314	8,646	-7.2	20,800	17,222	-17.2
17	Textiles		12,163	11,558	-5.1	5,821	4,670	-18.9	5,987	6,193	3.4	7,695	6,942	-9.8
20	Wood and products of wood and cork (except furniture); articles of straw and plaiting materials		3,020	2,617	-13.3	564	350	-38.0	1,050	1,103	5.0	944	795	-15.8
21	Pulp, paper and paper products		9,851	11,727	17.8	1,488	1,195	-19.8	9,045	10,918	20.7	4,175	5,164	23.7
23	Coke, refined petroleum products and nuclear fuel		196,534	176,187	-10.4	187,563	170,000	-9.4	4,939	5,006	1.4	12,655	8,234	-35.0
24	Fibres		57,892	49,382	-14.7	6,992	2,298	-18.9	48,381	43,920	-5.3	15,660	17,834	13.9
25	Rubber and plastic products		9,658	9,789	0.7	2,454	1,727	-28.6	6,727	7,612	16.1	4,012	4,566	14.3
26	Other non-metallic mineral products		16,613	15,208	-8.5	6,531	5,533	-15.3	9,527	10,302	8.1	2,895	2,936	1.4
27	Basic metals		49,020	57,284	16.9	0	0	0	45,874	53,223	16.0	12,587	19,751	55.7
28	and equipment		22,673	21,871	-3.5	2,621	2,110	-19.5	9,994	9,879	-0.1	8,171	8,705	6.5
29	Machinery and equipment n.e.c.		60,185	47,387	-21.3	3,044	2,822	-13.9	30,780	26,779	-12.9	22,078	20,575	-5.6
31	Electrical machinery and apparatus n.e.c.		11,521	13,309	15.5	380	356	-6.3	7,096	8,507	19.8	4,208	6,394	51.8
32	Radio, television and communication equipment and apparatus		8,621	14,343	68.4	1,852	2,209	33.7	3,500	7,921	126.3	4,491	9,538	114.6
34	Motor vehicles, trailers and semi-trailers		72,239	72,439	0.3	25,738	20,897	-16.8	29,507	42,099	42.2	32,562	36,511	12.1
35	Other transport equipment		12,130	14,939	23.2	1,122	1,039	-7.4	7,898	10,385	31.5	8,931	10,318	15.5
40	Electrical energy, gas, steam and hot water		152,321	144,653	-5.0	145,568	138,915	-4.6	6,558	4,578	-30.2	4,602	4,391	-4.6
41	Collected and purified water; distribution services of water		3,739	2,030	-45.7	3,718	2,020	-45.8	20	0	0	187	138	-26.3
45	Construction work		78,419	68,127	-13.1	1,263	1,026	-20.0	164	38	-79.3	15,798	14,568	-7.8
11-12, 16, 18-19, 22, 30, 31, 36-37	Products of other production industries		89,810	99,312	10.6	66,414	74,215	11.7	14,163	15,311	8.1	28,133	31,453	11.8
G-O	Service activities, total		260,524	219,648	-15.7	138,867	121,027	-12.7	23,254	26,712	14.9	36,076	33,826	-6.2
51-52	Wholesale trade and commission trade services, except of motor vehicles and motorcycles; retail trade services, except of motor vehicles and motorcycles; repair services of personal and household goods		54,358	43,285	-20.4	41,544	32,149	-22.6	6,514	6,395	-1.8	5,572	4,769	-14.4
60	Land transport and transport via pipeline services		20,551	28,572	29.4	16,248	16,987	11.4	3,622	7,068	95.1	2,092	3,013	44.0
62	Air transport services		15,526	15,733	1.3	8,758	10,645	21.5	5,764	5,061	-25.2	4,072	3,484	-14.4
75	Public administration and defence services; compulsory social security services+B16		40,113	24,878	-38.0	1,029	863	-35.6	168	86	-60.8	4,221	3,147	-25.4
SR, 61, 63, 84-74, 85-95	Other service activities		129,996	109,180	-16.0	72,088	60,583	-16.0	5,156	6,122	31.3	20,118	19,415	-3.5
A-G	All product groups		1,228,658	1,122,004	-8.7	684,873	611,164	-10.8	280,851	303,246	6.0	252,858	264,193	4.5

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**Table 39: International comparison  
Energy related CO<sub>2</sub>-emissions 1990 and 1998**

Region/Country	1990		1998		Share of global energy related CO <sub>2</sub> -emissions in GWh	
	Emis.	Emis.	Emis.	Emis.	Emis.	Emis.
OECD	10,955.7	11,992.6	9.5	55.4	10.9	
Canada	430.2	499.6	16.1	2.3	15.8	
Mexico	292.0	351.6	20.4	1.6	3.7	
USA	4,827.4	5,433.3	12.6	25.1	20.1	
Japan	1,018.7	1,099.3	7.9	5.1	8.9	
Korea	229.9	365.5	59.0	1.7	8.0	
Australia	258.9	317.2	22.5	1.5	16.6	
New Zealand	21.9	27.8	26.9	0.1	8.0	
Austria	57.4	61.2	6.6	0.3	7.6	
Belgium	106.5	119.3	12.0	0.6	12.0	
Czech Republic	154.1	113.6	26.3	0.5	11.7	
Denmark	50.9	56.7	11.4	0.3	10.8	
Finland	55.0	56.6	2.9	0.3	11.6	
France	352.7	382.2	8.4	1.8	6.4	
Germany <sup>1)</sup>	961.9	863.9	- 10.2	4.0	10.5	
Greece	70.6	83.6	18.4	0.4	7.9	
Hungary	70.5	57.5	- 18.4	0.3	5.7	
Iceland	1.9	2.1	10.5	0.0	7.7	
Ireland	30.3	37.9	25.1	0.2	10.4	
Italy	399.4	423.8	6.1	2.0	7.5	
Luxembourg	10.5	7.2	- 31.4	0.0	16.9	
Netherlands	159.8	175.9	10.1	0.8	10.9	
Norwegen	28.5	36.9	29.5	0.2	7.8	
Poland	340.7	313.7	- 7.9	1.4	8.3	
Portugal	39.6	53.5	35.1	0.2	5.5	
Spain	206.4	248.6	20.4	1.1	6.5	
Sweden	51.2	53.2	3.9	0.2	6.1	
Switzerland	39.9	41.0	2.8	0.2	5.7	
Turkey	128.8	182.1	41.4	0.8	2.9	
United Kingdom	560.3	527.7	- 5.8	2.4	9.3	
Europe (Nicht-OECD)	427.7	288.6	- 32.5	1.3	4.6	
Africa	540.5	693.1	28.2	3.2	1.0	
Asia	1,332.4	1,999.6	50.1	9.2	1.1	
People's Rep. of China <sup>2)</sup>	2,276.5	2,846.2	25.0	13.1	2.3	
Ex-USSR	3,344.8	2,070.9	- 38.1	9.6	7.6	
Latin America	601.9	833.6	38.5	3.9	2.2	
Middle East	596.0	924.2	55.1	4.3	5.8	
World <sup>3)</sup>	20,075.5	21,648.9	7.8	100.0	3.9	

1) Differences from data of the German Government due to special OECD calculations.

2) Including Hongkong.

3) Without international transport (1990: 637.7 mn.t; 1998: 720.3 mn.t).

Source: Organisation for Economic Cooperation and Development (OECD)

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