行政院所屬各機關因公出國人員出國報告書

（出國類別：考察）

赴 OECD 以及挪威等四國考察
研究發展與技術創新調查

出國人：王顯達教授

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行政院研考會/省（市）研考會編號欄
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出國地點 ：挪威、德國、法國、荷蘭

出國期間 八十九年十一月二十四日至十二月九日

報告時間 九十年三月一日

目　　錄

一、考察目的

（一）經濟合作發展組織（OECD）為國際知名之科技統計研究機構，其所建議之各項統計調查規範為國際所採用的標準之一，其建置之各項統計資料庫亦常為國際間從事相關研究之主要資料來源之一。本會實施科技動態調查已有二十年，每年將結果彙編為「科學技術統計要覽」，提供國內外各界使用。近年來，為了將我國科技統計資料納入該組織之資料庫，本會積極與 OECD 保持聯繫，本次行程即赴巴黎，與 OECD/DSTI 處長 Dr. Andrew W. Wyckoff 洽談我國科技統計資料納入資料庫事宜，並就雙方未來合作議題交換意見。

（二）技術創新調查結果可以進一步了解國內產業技術創新活動之概況，包括產業創新資訊之來源、創新活動之模式，所遭遇之困難或阻礙以及創新對企業產生之效益等。本會基於實施研發調查之多年經驗，亟欲蒐集此一方面之資訊，正規劃於 90 年試辦「台灣地區技術創新調查」計畫。本行程將安排赴挪威、德國、法國與荷蘭等國家，參訪各國之技術創新調查機構，訪談實施經驗並蒐集相關資料，以作為我國未來實施之參考。

二、考察行程

日期	地點	行程
11/24(五)	台北	晚上7:35出發
11/25(六)	阿姆斯特丹(Amsterdam)	
11/26(日)	奧斯陸(Oslo)	
11/27(一)	奧斯陸(Oslo)	訪問**Dr. Smith, STEP Group**
11/28(二)	奧斯陸(Oslo)	訪問**Dr. Nas, STEP Group**
11/29(三)	奧斯陸(Oslo) / 法蘭克福(Frankfurt) / 曼漢姆(Mannheim)	奧斯陸飛往法蘭克福，搭車至曼漢姆
11/30(四)	曼漢姆(Mannheim) / 埃森(Essen)	訪問**Dr.Janz與Mr.Ebling等，歐洲經濟研究中心(ZEW)**
12/01(五)	埃森 (Essen) / 法蘭克福(Frankfurt)	訪問**Dr.Grenzmann等，Stifterverband for Deutsche Science Statistics**
12/02(六)	法蘭克福(Frankfurt) / 巴黎(Paris)	法蘭克福飛往巴黎
12/03(日)	巴黎(Paris)	
12/04(一)	巴黎(Paris)	訪問法國國家教育部與工業部統計局
12/05(二)	巴黎(Paris)	**與OECD報告我國洽談R&D調查之成果與我國科技統計資料納入OECD資料庫**
12/06(三)	巴黎(Paris) / 阿姆斯特丹(Amsterdam)	巴黎飛往荷蘭
12/07(四)	阿姆斯特丹(Amsterdam) / 海牙(Haag)	訪問**Dr. Klomp等,荷蘭中央統計局**
12/08(五)	海牙(Haag) / 來登(Leiden)	訪問**Dr. Tijssen, 來登大學科技研究中心（CWTS）**
12/09(六)	阿姆斯特丹(Amsterdam) / 台北	回程

三、考察重點

（一）向 OECD 說明我國執行研發調查之成果

（二）洽談將我國科技統計資料納入 OECD 資料庫事宜。

（三）洽談我國與 OECD 未來合作研究之議題。

（四）瞭解各國技術創新調查執行機構、方式與成果。

（五）瞭解各國技術創新的定義及其調查基礎。

（六）瞭解各國執行創新調查的經驗，包括母體之建立、抽樣率、回收率以及問題解決方式。

（七）瞭解各國執行創新調查所涵蓋的產業範圍。

（八）瞭解歐盟實施創新調查之問卷設計方法及其重點內容。

（九）討論技術創新調查問卷有關阻礙因素(hampering factors)問項之政策意涵。

（十）瞭解研發調查與創新調查之間的關連性及其意義

（十一）討論各國資訊通訊技術（Information and Communication Technology）指標之意義。

（十二）瞭解各國有關知識經濟指標之研究

四、考察過程

（一）挪威

1.時間：11/27(一)

2.地點：奧斯陸(Oslo)

3.訪問對象：

Dr. Keith Smith, STEP Group

Research Director (the author of 奧斯陸手冊 1992)

Studies in Technology, Innovation and Economic Policy (STEP)
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4.訪問重點

STEP Group 位於奧斯陸（Oslo），為一民間非營利研究機構，與挪威官方之研究委員會（Research Council）訂有長期性契約(project-based)。STEP 成立於 1980 晚期，原專責於技術創新調查之研究。Dr. Kieth Smith 即為 OECD 技術創新調查規範（奧斯陸手冊）1992 年版之起草人。技術創新調查原屬非官方性質之研究活動，受到 OECD 與歐盟之大力鼓吹，慢慢地受到各國重視。目前挪威係由政府出面調查，STEP 則專責從事調查數據之分析工作。

有關討論重點摘錄如下：

（1）歐盟技術創新調查（Community Innovation Survey）係由歐盟出資，問卷內容則由會員國共同參與討論。

（2）歐盟已經實施兩次創新調查，目前籌畫中之第三次調查（CIS Ⅲ）之問卷內容正依據各國實施經驗與需求進行研商與修訂，此次並未完全參照奧斯陸手冊，並且縮短問卷題目之長度，希望頁數能盡量控制在四頁以內。

（3）奧斯陸手冊的第二版（1997）與第一版（1992）（原為 Dr. Smith 主筆）已作許多修訂。

（4）技術創新與研究發展之差異在於創新活動強調經濟性結果，必須具有商業目的，其結果以接受市場考驗為目的。研發活動則偏重技術性，其過程充滿不確定性。

（5）目前歐盟創新調查仍著重於調查產業技術之創新(technological innovation)，對產業組織之變革並未深入探究，原因是目前僅

前者能夠量化比較。

（6）歐盟創新調查之對象普遍以員工數 10 人以上之企業為主，但 Smith 以挪威國家為例，認為目前 OECD 之標準（cut-off point）應再降低，因為很多新創的企業，其員工人數均少於 5-10 人。

（7）歐盟創新調查對大型企業應採普查方式，中小型企業則採抽樣調查。

（8）挪威為了實施問卷調查設有專線服務，以回答受訪者有關問卷問題的疑問。

（9）在創新調查之基礎方面，以機構（establishmen）、企業（enterprise）、工廠（Firm）三個層次而言，應以企業為調查基礎。

（10）歐盟創新調查之問卷回收率普遍還不錯，但每個國家的情形不盡相同。挪威雖然法律規定人民有回答義務，但並不具罰則，挪威 CIS I 調查有 50%，CIS II 調查也有 70%以上。但在美國 Georgia State 曾經試辦過只有 14%回收率，造成嚴重的樣本誤差（sample bias）。

（11）澳洲曾將研發調查與創新調查合併實施，但研發調查以調查企業本身出資之研發活動為主，創新活動則不限創新技術與資訊之來源。事實上，很多企業的創新並非來自企業本身之研究發展部門，造成調查資料不易解釋。此外，許多傳統企業大都沒有從事研發活動，卻使用很多研發的成果從事創新活動，容易產生填卷之困擾。

（12）對於知識經濟之研究，丹麥 NAAS 曾利用問卷上所設之統一編號，辨認與連結不同的問卷，如研發調查、創新調查等，以進行知識經濟相關之研究。

（13）目前未實施創新調查之國家方面，日本確實沒有實施，其原因不清楚。美國國家科學基金會（NSF）曾依據奧斯陸手冊進行過長期研究，但實際調查仍困難重重。至於韓國曾參與 CIS II 調查。

（14）資訊通訊技術（ICT）指標雖然對政策制訂者很重要。但 Dr. Smith 認為，到目前為止仍侷限於一些 PC、Internet 之數量統計，不具經濟意義，對其政策意涵持保留態度。

（15）Dr. Smith 認為創新調查雖然有助於數據資料之蒐集，但更重要的是充分運用這些數據資料來分析經濟現象才有意義。

（二）挪威

1.時間：11/28(二)

2.地點：奧斯陸(Oslo)

3.訪問對象：

Mr. Nas, STEP Group
Researcher, Studies in Technology, Innovation and Economic Policy (STEP Group)
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4.討論重點

（1）挪威參與歐盟技術創新調查（Community Innovation Survey；CIS），由歐盟統一訂定核心問卷（core question），各國再視需要自行加入問項。1992 年執行 CIS I 調查，1997 年執行 CIS II 調查，預計於 2001 年執行 CIS III 調查。

（2）挪威調查方式視產業而定，主要以大型企業公司採普查方式。員工人數在 50 至 100 人者，抽樣 50%。20 人以下則抽樣 10-20%。

（3）為了要瞭解所有創新的細節，所以 CIS 問卷題目很多，目前正在研擬的新版 CIS Ⅲ題目更多，但題目已大幅簡化，較容易回答，問題之前都會有簡短提示，其後才是選項。

（4）對於創新成本 (innovation cost)方面，目前仍無法經由調查得到精確數字。

（5）企業創新與就業率升降之關聯性，就推論而言，製程改良表示成本下降，可增進公司價值，但可能減少雇用人數；而產品改良，表示能力提升，不但可增進公司價值，且可能增加雇用人數。

（6）新版 CIS Ⅲ問卷已減少調查廠商創新之目的，但加重調查廠商創新活動之效果。

（7）有關阻礙因素等問項之設計，可讓政策制訂者瞭解廠商從事創新時所面臨的一般性困難，但僅供參考而已；若要進一步擬定政策來解決問題，仍須針對問題深入調查研究才能得到。

（8）由於官方註冊資料(registered data)極為豐富，在挪威每一個人都有統一編號 (在就業、稅籍和社會福利等方面)，挪威政府資訊部門（data supervisor）根據挪威法律蒐集這些個人/廠商資料，並彙整其他單位經調查取得之資料。STEP 研究人員經過申請與審查程序，可以取得這些廠商及個人資料來進行研究，觀察廠商的地區分布情形，並斷定哪些廠商是新成立的、或是合併、或是分出來的單位。但這些資料僅供整體研究而已，對

於個別資料之隱私仍給與保護。其他如瑞典、丹麥、芬蘭也有類似資料與作法。法國、荷蘭雖有這些資料，但目前並未使用。

（9）由於研發調查(以 Frascati Manual 為基礎)、創新調查(奧斯陸手冊 Manual)、技術貿易(Technology Balance of Payment Manual)、專利統計(Patent Manual)、科技人力資源調查(Canberra Manual) 等調查的對象不同，難以整合，且國際評比也難，故挪威尚未合併各項調查。但是芬蘭已嘗試整合相關調查，我國如有此需要，可以連繫參考。

（三）德國

1.時間：11/30(四)

2.地點：歐洲經濟研究中心(ZEW) ，位於曼漢姆(Mannheim)

3. 訪問對象：

Dr. Georg Licht

Head of Industrial Economics and International Management
Center for European Economic Research (ZEW)
Tel: +49 (0)621 1235177 e-mail: licht@zew.de

Dr. Norbert Janz
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Mr. Gunther Ebling
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Mr. Marian Beise
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4.討論重點

（1）歐洲經濟研究中心位於德國曼漢姆，為一非營利研究機構，所參訪之 Industrial Economics and International Management 部門，其研究重點著重於創新系統與創新活動之內涵（包括創新與人力需求、教育訓練、生產力、出口、市場結構、專利之關係等）、創新活動的衡量與指標設計、創新管理、技術進步與擴散過程、廠商動態及新興市場調查、相關科技政策的績效評估。

（2）德國參與歐盟工作小組進行創新調查問卷之設計，而執行創新調查的 *Mannheim Innovation Panel (MIP)*是由聯邦教育研究部(BMBF)出資，委託 ZEW 執行調查。

（3）訪談德國創新調查(MIP)之經驗—調查方法論與計量方法、創新的定義、問卷設計基礎(奧斯陸手冊 、CIS Core Questionnaire)、Data Base、產業範圍(NACE 10-13,15-37, 40, 41, 45, 50-93；分製造業 MIP 及服務業 MIP-S)、母體（依產業、廠商規模、及地區分類）、樣本（MIP: 10,557 家；MIP-S: 11,737 家）、回收率(志願性回卷,回卷率約 30%)。

（4）德國研發調查係由 BMBF 委託其他單位執行，故目前尚未考慮與研發調查合併實施。

（5）依據德國創新調查顯示，目前德國廠商所面臨的最大困難是找不到合適的人才。

（四）德國

1.時間：12/01(五)

2.地點：埃森(Essen)

3.訪問對象：

Dr.Grenzmann,
Stifterverband for Deutsche Science Statistics

Dr. Christoph Grenzmann
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Wissenschaftsstatistik@compuserve.com

Mr. Rudiger Marquardt
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4.訪問重點

（1）訪談德國研究發展調查之問卷內容，德國針對不同企業規模或性質，設計不同繁簡程度之四種問卷。
（2）訪談德國研究發展調查之經驗。
（3）比較德國與其他國家研究發展調查之成果。
（4）瞭解德國企業從事研究發展之比率。

（五）法國

1.時間：12/04(一)

2.地點：：法國國家教育部與工業部統計局，位於巴黎(Paris)

3.訪問對象

Mr. Florent Favre
Bureau of the Industrial Statistics of the Ministry of Industry

Mr. Yves Jacquin
Ministry of National Education (for R&D Survey)
TEL:+33 01 55 55 76 52
e-mail:yves.jacuin@education.gouv.fr

4.訪問重點

（1）法國創新調查由工業部統計局執行。
（2）瞭解法國對於創新調查的定義(以調查技術性創新為主)及其調查基礎(以"企業"為單位)。
（3）瞭解法國執行創新調查的經驗(廠商總數 25,000，發 5,000 份問卷，抽樣率 20%，強制性回卷，回收率達 85%) 。
（4）瞭解法國執行創新調查所涵蓋的產業範圍(NACE 45,52,54,60-62,64...etc.)。
（5）討論創新調查問卷問題的設計(以 CISII 為基礎)，儘量以%、qualitative、李克 Scale 的方式來設計問題。
（6）討論創新調查的內容，包括：員工流動調查及管理、專利、

組織改造、仿冒、創新活動內部化及外部化調查，以及調查廠商的創新活動延遲或放棄的理由等。

（7）討論創新調查(hampering factors)的政策意涵

（六）經濟合作發展組織（OECD）

1.時間：12/05(二)

2.地點：OECD，位於巴黎(Paris)

3.訪問對象

Dr. Andrew W. Wyckoff
Head of the Economic Analysis and Statistics Division
OECD

Dr. Laudeline auriol
Administrator
Economic Analysis and Statistics Division
OECD

Mr. Dominique Guellec
Economic Analysis and Statistics Division

Genevieve Muzart
Economic Analysis and Statistics Division

4.訪問重點

(1)向 OECD/DSTI 說明我國執行研究發展調查（科技動態調查）之品質與成果，已獲其認可並承諾將於明(2001)年在 OECD 出版品上呈現我國研發相關數據。

(2)就雙方在技術創新調查之合作交換初步意見。

（七）荷蘭

1.時間：12/07(四)

2.地點：荷蘭中央統計局，位於海牙(Haag)

3.訪問對象：

Dr. L. Klomp
Analyst in Technology
Central Bureau of Statistics
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Mr. Gerhard.W. Meinen
Project Group of R&D and Innovation Statistics Netherlands
Central Bureau of Statistics
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4.訪問重點

（1）荷蘭創新調查的問卷設計與相關定義亦以技術性創新為主。
（2）荷蘭因製造業與服務業之不同，在創新調查問卷設計上有差異。
（3）荷蘭在研發調查與創新調查並未作聯結。
（4）荷蘭執行機構中央統計局（Central Bureau of Statistics）雖屬經濟部，但實際上極為中立。創新調查係由該局 Project Group of R&D and Innovation Statistics，成員有八人，負責研發與創新調查(隔年調查)。
（5）荷蘭亦以大企業採普查方式，小企業則採抽查，屬於志願性回卷，回收率卻高達 73%。

（八）荷蘭

1.時間：12/08(五)

2.地點：來登大學科技研究中心（CWTS），位於荷蘭來登(Leiden)

3.訪問對象：

Dr. R.J.W. Tijssen
Associate Professor

Center for Science and Technology Studies (CWTS)
Leiden University
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e-mail: tijssen@cwts.leidenuniv.nl

4.訪問重點

（1）來登大學科技研究中心（CWTS）已建置專利資料及學術期刊資料庫，可供進行科技研發成果之分析研究，目前與本會科資中心將就學術期刊資料庫進行合作。

（2）討論大學除了教學研究外在產業創新過程所扮演的角色。

（3）討論科學(Science)研究與技術(Technology)發展的關係。

（4）簡介該中心利用專利參考文獻(citations)以數量方法評估研發與創新之關連性。

五、考察結果與心得

（一）此次經國科會指派將我國 1999 年研究發展調查（科技動態調查）之統計資料，依據 OECD 之定義產生資料並攜往 OECD 說明，已獲肯定並同意將於明年正式將我國資料納入資料庫（Main Science and Technology Indicators）。

（二）經濟合作發展組織是最早以系統性方法，蒐集分析科技統計數據之國際組織，並建立各項規範，包括研發調查之弗城手冊（Frascati Manual）、技術創新調查之奧斯陸手冊 (Oslo Manual)、技術貿易之 TIP 手冊(Technology Balance of Payment Manual)、專利統計手冊 (Patent Manual)、科技人力資源之坎培拉手冊(Canberra Manual) 等，建議我國相關單位之調查數據應致力於採用 OECD 之規範，以便具備國際評比之條件，未來作為決策參考時能更具客觀的價值。

（三）科技統計調查對於新興產業發展政策極具重要意義，部分歐洲國家在上述調查與研究上已累積相當的調查經驗及成果，建議本會應加強與 OECD、歐盟 Eurostat 等國際組織相關研究機構進行交流與合作。對於一些具豐富研究經驗及成果之各國研究單位，如挪威 STEP Group、德國歐洲經濟研究中心(ZEW)以及荷蘭來登大學科技研究中心（CWTS）等亦應保持聯繫，充分運用我國相關調查資料與研究，使科技統計資料研究能支援經濟發展與產業政策。

（四）此次考察行程中，挪威、德國等調查機構由經濟觀點認為創新調查結果應以滿足經濟分析之需求為目的，與法國、荷蘭崇尚務實，以能找出較精確，具統計意義的資訊為調查目標之作法，大異其趣。前者雖易流於好高騖遠，但對技術創新調查之後續發展極為重要。兩項觀點利弊參半，也是歐盟第三次調查問卷最大爭議所在，我國未來應以務實面著手，但創新研究之動向仍有必要繼續追蹤瞭解。

目　　錄

一、考察目的

（一）經濟合作發展組織（OECD）為國際知名之科技統計研究機構，其所建議之各項統計調查規範為國際所採用的標準之一，其建置之各項統計資料庫亦常為國際間從事相關研究之主要資料來源之一。本會實施科技動態調查已有二十年，每年將結果彙編為「科學技術統計要覽」，提供國內外各界使用。近年來，為了將我國科技統計資料納入該組織之資料庫，本會積極與OECD保持聯繫，本次行程即赴巴黎，與OECD/DSTI處長Dr. Andrew W. Wyckoff洽談我國科技統計資料納入資料庫事宜，並就雙方未來合作議題交換意見。

（二）技術創新調查結果可以進一步了解國內產業技術創新活動之概況，包括產業創新資訊之來源、創新活動之模式，所遭遇之困難或阻礙以及創新對企業產生之效益等。本會基於實施研發調查之多年經驗，亟欲蒐集此一方面之資訊，正規劃於90年試辦「台灣地區技術創新調查」計畫。本行程將安排赴挪威、德國、法國與荷蘭等國家，參訪各國之技術創新調查機構，訪談實施經驗並蒐集相關資料，以作為我國未來實施之參考。

二、考察行程

日期	地點	行程
11/24(五)	台北	晚上7:35出發
11/25(六)	阿姆斯特丹(Amsterdam)	
11/26(日)	奧斯陸(Oslo)	
11/27(一)	奧斯陸(Oslo)	訪問**Dr. Smith, STEP Group**
11/28(二)	奧斯陸(Oslo)	訪問**Dr. Nas, STEP Group**
11/29(三)	奧斯陸(Oslo) / 法蘭克福(Frankfurt) / 曼漢姆(Mannheim)	奧斯陸飛往法蘭克福，搭車至曼漢姆
11/30(四)	曼漢姆(Mannheim) / 埃森(Essen)	訪問**Dr.Janz與Mr.Ebling等，歐洲經濟研究中心(ZEW)**
12/01(五)	埃森 (Essen) / 法蘭克福(Frankfurt)	訪問**Dr.Grenzmann等，Stifterverband for Deutsche Science Statistics**
12/02(六)	法蘭克福(Frankfurt) / 巴黎(Paris)	法蘭克福飛往巴黎
12/03(日)	巴黎(Paris)	
12/04(一)	巴黎(Paris)	訪問法國國家教育部與工業部統計局
12/05(二)	巴黎(Paris)	**與OECD報告我國洽談R&D調查之成果與我國科技統計資料納入OECD資料庫**
12/06(三)	巴黎(Paris) / 阿姆斯特丹(Amsterdam)	巴黎飛往荷蘭
12/07(四)	阿姆斯特丹(Amsterdam) / 海牙(Haag)	訪問**Dr. Klomp等,荷蘭中央統計局**
12/08(五)	海牙(Haag) / 來登(Leiden)	訪問**Dr. Tijssen, 來登大學科技研究中心（CWTS）**
12/09(六)	阿姆斯特丹(Amsterdam) / 台北	回程

三、考察重點

（一）向 OECD 說明我國執行研發調查之成果

（二）洽談將我國科技統計資料納入 OECD 資料庫事宜。

（三）洽談我國與 OECD 未來合作研究之議題。

（四）瞭解各國技術創新調查執行機構、方式與成果。

（五）瞭解各國技術創新的定義及其調查基礎。

（六）瞭解各國執行創新調查的經驗，包括母體之建立、抽樣率、回收率以及問題解決方式。

（七）瞭解各國執行創新調查所涵蓋的產業範圍。

（八）瞭解歐盟實施創新調查之問卷設計方法及其重點內容。

（九）討論技術創新調查問卷有關阻礙因素(hampering factors)問項之政策意涵。

（十）瞭解研發調查與創新調查之間的關連性及其意義

（十一）討論各國資訊通訊技術（Information and Communication Technology）指標之意義。

（十二）瞭解各國有關知識經濟指標之研究

四、考察過程

（一）挪威

1.時間：11/27(一)

2.地點：奧斯陸(Oslo)

3.訪問對象：

Dr. Keith Smith, STEP Group

Research Director (the author of 奧斯陸手冊 1992)

Studies in Technology, Innovation and Economic Policy (STEP)
TEL: +47 2242 9780　e-mail: kieth.smith@step.no

4.訪問重點

STEP Group 位於奧斯陸（Oslo），為一民間非營利研究機構，與挪威官方之研究委員會（Research Council）訂有長期性契約(project-based)。STEP 成立於 1980 晚期，原專責於技術創新調查之研究。Dr. Kieth Smith 即為 OECD 技術創新調查規範（奧斯陸手冊）1992 年版之起草人。技術創新調查原屬非官方性質之研究活動，受到 OECD 與歐盟之大力鼓吹，慢慢地受到各國重視。目前挪威係由政府出面調查，STEP 則專責從事調查數據之分析工作。

有關討論重點摘錄如下：

（1）歐盟技術創新調查（Community Innovation Survey）係由歐盟出資，問卷內容則由會員國共同參與討論。

（2）歐盟已經實施兩次創新調查，目前籌畫中之第三次調查（CIS Ⅲ）之問卷內容正依據各國實施經驗與需求進行研商與修訂，此次並未完全參照奧斯陸手冊，並且縮短問卷題目之長度，希望頁數能盡量控制在四頁以內。

（3）奧斯陸手冊的第二版（1997）與第一版（1992）（原為 Dr. Smith 主筆）已作許多修訂。

（4）技術創新與研究發展之差異在於創新活動強調經濟性結果，必須具有商業目的，其結果以接受市場考驗為目的。研發活動則偏重技術性，其過程充滿不確定性。

（5）目前歐盟創新調查仍著重於調查產業技術之創新(technological innovation)，對產業組織之變革並未深入探究，原因是目前僅

前者能夠量化比較。

（6）歐盟創新調查之對象普遍以員工數 10 人以上之企業為主，但 Smith 以挪威國家為例，認為目前 OECD 之標準（cut-off point）應再降低，因為很多新創的企業，其員工人數均少於 5-10 人。

（7）歐盟創新調查對大型企業應採普查方式，中小型企業則採抽樣調查。

（8）挪威為了實施問卷調查設有專線服務，以回答受訪者有關問卷問題的疑問。

（9）在創新調查之基礎方面，以機構（establishmen）、企業（enterprise）、工廠（Firm）三個層次而言，應以企業為調查基礎。

（10）歐盟創新調查之問卷回收率普遍還不錯，但每個國家的情形不盡相同。挪威雖然法律規定人民有回答義務，但並不具罰則，挪威 CIS I 調查有 50%，CIS II 調查也有 70%以上。但在美國 Georgia State 曾經試辦過只有 14%回收率，造成嚴重的樣本誤差（sample bias）。

（11）澳洲曾將研發調查與創新調查合併實施，但研發調查以調查企業本身出資之研發活動為主，創新活動則不限創新技術與資訊之來源。事實上，很多企業的創新並非來自企業本身之研究發展部門，造成調查資料不易解釋。此外，許多傳統企業大都沒有從事研發活動，卻使用很多研發的成果從事創新活動，容易產生填卷之困擾。

（12）對於知識經濟之研究，丹麥 NAAS 曾利用問卷上所設之統一編號，辨認與連結不同的問卷，如研發調查、創新調查等，以進行知識經濟相關之研究。

（13）目前未實施創新調查之國家方面，日本確實沒有實施，其原因不清楚。美國國家科學基金會（NSF）曾依據奧斯陸手冊進行過長期研究，但實際調查仍困難重重。至於韓國曾參與 CIS II 調查。

（14）資訊通訊技術（ICT）指標雖然對政策制訂者很重要。但 Dr. Smith 認為，到目前為止仍侷限於一些 PC、Internet 之數量統計，不具經濟意義，對其政策意涵持保留態度。

（15）Dr. Smith 認為創新調查雖然有助於數據資料之蒐集，但更重要的是充分運用這些數據資料來分析經濟現象才有意義。

（二）挪威

1.時間：11/28(二)

2.地點：奧斯陸(Oslo)

3.訪問對象：

Mr. Nas, STEP Group
Researcher, Studies in Technology, Innovation and Economic Policy (STEP Group)
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4.討論重點

（1）挪威參與歐盟技術創新調查（Community Innovation Survey；CIS），由歐盟統一訂定核心問卷（core question），各國再視需要自行加入問項。1992 年執行 CIS I 調查，1997 年執行 CIS II 調查，預計於 2001 年執行 CIS III 調查。

（2）挪威調查方式視產業而定，主要以大型企業公司採普查方式。員工人數在 50 至 100 人者，抽樣 50%。20 人以下則抽樣 10-20%。

（3）為了要瞭解所有創新的細節，所以 CIS 問卷題目很多，目前正在研擬的新版 CISⅢ題目更多，但題目已大幅簡化，較容易回答，問題之前都會有簡短提示，其後才是選項。

（4）對於創新成本 (innovation cost)方面，目前仍無法經由調查得到精確數字。

（5）企業創新與就業率升降之關聯性，就推論而言，製程改良表示成本下降，可增進公司價值，但可能減少雇用人數；而產品改良，表示能力提升，不但可增進公司價值，且可能增加雇用人數。

（6）新版 CISⅢ問卷已減少調查廠商創新之目的，但加重調查廠商創新活動之效果。

（7）有關阻礙因素等問項之設計，可讓政策制訂者瞭解廠商從事創新時所面臨的一般性困難，但僅供參考而已；若要進一步擬定政策來解決問題，仍須針對問題深入調查研究才能得到。

（8）由於官方註冊資料(registered data)極為豐富，在挪威每一個人都有統一編號 (在就業、稅籍和社會福利等方面)，挪威政府資訊部門（data supervisor）根據挪威法律蒐集這些個人/廠商資料，並彙整其他單位經調查取得之資料。STEP 研究人員經過申請與審查程序，可以取得這些廠商及個人資料來進行研究，觀察廠商的地區分布情形，並斷定哪些廠商是新成立的、或是合併、或是分出來的單位。但這些資料僅供整體研究而已，對

於個別資料之隱私仍給與保護。其他如瑞典、丹麥、芬蘭也有類似資料與作法。法國、荷蘭雖有這些資料，但目前並未使用。

（9）由於研發調查(以 Frascati Manual 為基礎)、創新調查(奧斯陸手冊 Manual)、技術貿易(Technology Balance of Payment Manual)、專利統計(Patent Manual)、科技人力資源調查(Canberra Manual) 等調查的對象不同，難以整合，且國際評比也難，故挪威尚未合併各項調查。但是芬蘭已嘗試整合相關調查，我國如有此需要，可以連繫參考。

（三）德國

1.時間：11/30(四)

2.地點：歐洲經濟研究中心(ZEW) ，位於曼漢姆(Mannheim)

3. 訪問對象：

Dr. Georg Licht

Head of Industrial Economics and International Management
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Tel: +49 (0)621 1235177 e-mail: licht@zew.de

Dr. Norbert Janz
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Center for European Economic Research (ZEW)
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Mr. Gunther Ebling
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Mr. Marian Beise
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Center for European Economic Research (ZEW)
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4.討論重點

（1）歐洲經濟研究中心位於德國曼漢姆，為一非營利研究機構，所參訪之 Industrial Economics and International Management 部門，其研究重點著重於創新系統與創新活動之內涵（包括創新與人力需求、教育訓練、生產力、出口、市場結構、專利之關係等）、創新活動的衡量與指標設計、創新管理、技術進步與擴散過程、廠商動態及新興市場調查、相關科技政策的績效評估。

（2）德國參與歐盟工作小組進行創新調查問卷之設計，而執行創新調查的 *Mannheim Innovation Panel (MIP)* 是由聯邦教育研究部(BMBF)出資，委託 ZEW 執行調查。

（3）訪談德國創新調查(MIP)之經驗—調查方法論與計量方法、創新的定義、問卷設計基礎(奧斯陸手冊 、CIS Core Questionnaire)、Data Base、產業範圍(NACE 10-13,15-37, 40, 41, 45, 50-93；分製造業 MIP 及服務業 MIP-S)、母體（依產業、廠商規模、及地區分類）、樣本（MIP: 10,557 家；MIP-S: 11,737 家）、回收率(志願性回卷,回卷率約 30%)。

（4）德國研發調查係由 BMBF 委託其他單位執行，故目前尚未考慮與研發調查合併實施。

（5）依據德國創新調查顯示，目前德國廠商所面臨的最大困難是找不到合適的人才。

（四）德國

1.時間：12/01(五)

2.地點：埃森(Essen)

3.訪問對象：

Dr.Grenzmann,
Stifterverband for Deutsche Science Statistics

Dr. Christoph Grenzmann
Stifterverband for Deutsche Science Statistics
Tel: +49 (0)201 8401426 e-mail:
Wissenschaftsstatistik@compuserve.com

Mr. Rudiger Marquardt
Stifterverband for Deutsche Science Statistics
Tel: +49 (0)201 8401424　e-mail: r.marquardt@stifterverband.de

4.訪問重點

（1）訪談德國研究發展調查之問卷內容，德國針對不同企業規模或性質，設計不同繁簡程度之四種問卷。
（2）訪談德國研究發展調查之經驗。
（3）比較德國與其他國家研究發展調查之成果。
（4）瞭解德國企業從事研究發展之比率。

（五）法國

1.時間：12/04(一)

2.地點：：法國國家教育部與工業部統計局，位於巴黎(Paris)

3.訪問對象

Mr. Florent Favre
Bureau of the Industrial Statistics of the Ministry of Industry

Mr. Yves Jacquin
Ministry of National Education (for R&D Survey)
TEL:+33 01 55 55 76 52
e-mail:yves.jacuin@education.gouv.fr

4.訪問重點

（1）法國創新調查由工業部統計局執行。
（2）瞭解法國對於創新調查的定義(以調查技術性創新為主)及其調查基礎(以"企業"為單位)。
（3）瞭解法國執行創新調查的經驗(廠商總數 25,000，發 5,000 份問卷，抽樣率 20%，強制性回卷，回收率達 85%) 。
（4）瞭解法國執行創新調查所涵蓋的產業範圍(NACE 45,52,54,60-62,64...etc.)。
（5）討論創新調查問卷問題的設計(以 CISII 為基礎)，儘量以%、qualitative、李克 Scale 的方式來設計問題。
（6）討論創新調查的內容，包括：員工流動調查及管理、專利、

組織改造、仿冒、創新活動內部化及外部化調查，以及調查廠商的創新活動延遲或放棄的理由等。

（7）討論創新調查(hampering factors)的政策意涵

（六）經濟合作發展組織（OECD）

1.時間：12/05(二)

2.地點：OECD，位於巴黎(Paris)

3.訪問對象

Dr. Andrew W. Wyckoff
Head of the Economic Analysis and Statistics Division
OECD

Dr. Laudeline auriol
Administrator
Economic Analysis and Statistics Division
OECD

Mr. Dominique Guellec
Economic Analysis and Statistics Division

Genevieve Muzart
Economic Analysis and Statistics Division

4.訪問重點

(1)向 OECD/DSTI 說明我國執行研究發展調查（科技動態調查）之品質與成果，已獲其認可並承諾將於明(2001)年在 OECD 出版品上呈現我國研發相關數據。

(2)就雙方在技術創新調查之合作交換初步意見。

（七）荷蘭

1.時間：12/07(四)

2.地點：荷蘭中央統計局，位於海牙(Haag)

3.訪問對象：

Dr. L. Klomp
Analyst in Technology
Central Bureau of Statistics
TEL: +31 (0)70 3374354
e-mail: lklp@cbs.nl

Mr. Gerhard.W. Meinen
Project Group of R&D and Innovation Statistics Netherlands
Central Bureau of Statistics
TEL: +31 (0)70 3379228
e-mail: BMNE@CBS.NL

4.訪問重點

（1）荷蘭創新調查的問卷設計與相關定義亦以技術性創新為主。
（2）荷蘭因製造業與服務業之不同，在創新調查問卷設計上有差異。
（3）荷蘭在研發調查與創新調查並未作聯結。
（4）荷蘭執行機構中央統計局（Central Bureau of Statistics）雖屬經濟部，但實際上極為中立。創新調查係由該局 Project Group of R&D and Innovation Statistics，成員有八人，負責研發與創新調查(隔年調查)。
（5）荷蘭亦以大企業採普查方式，小企業則採抽查，屬於志願性回卷，回收率卻高達 73%。

（八）荷蘭

1.時間：12/08(五)

2.地點：來登大學科技研究中心（CWTS），位於荷蘭來登(Leiden)

3.訪問對象：

Dr. R.J.W. Tijssen
Associate Professor

Center for Science and Technology Studies (CWTS)
Leiden University
TEL: +31 (0)71 5273960
e-mail: tijssen@cwts.leidenuniv.nl

4.訪問重點

（1）來登大學科技研究中心（CWTS）已建置專利資料及學術期刊資料庫，可供進行科技研發成果之分析研究，目前與本會科資中心將就學術期刊資料庫進行合作。

（2）討論大學除了教學研究外在產業創新過程所扮演的角色。

（3）討論科學(Science)研究與技術(Technology)發展的關係。

（4）簡介該中心利用專利參考文獻(citations)以數量方法評估研發與創新之關連性。

五、考察結果與心得

（一）此次經國科會指派將我國 1999 年研究發展調查（科技動態調查）之統計資料，依據 OECD 之定義產生資料並攜往 OECD 說明，已獲肯定並同意將於明年正式將我國資料納入資料庫（Main Science and Technology Indicators）。

（二）經濟合作發展組織是最早以系統性方法，蒐集分析科技統計數據之國際組織，並建立各項規範，包括研發調查之弗城手冊（Frascati Manual）、技術創新調查之奧斯陸手冊 (Oslo Manual)、技術貿易之 TIP 手冊(Technology Balance of Payment Manual)、專利統計手冊 (Patent Manual)、科技人力資源之坎培拉手冊(Canberra Manual) 等，建議我國相關單位之調查數據應致力於採用 OECD 之規範，以便具備國際評比之條件，未來作為決策參考時能更具客觀的價值。

（三）科技統計調查對於新興產業發展政策極具重要意義，部分歐洲國家在上述調查與研究上已累積相當的調查經驗及成果，建議本會應加強與 OECD、歐盟 Eurostat 等國際組織相關研究機構進行交流與合作。對於一些具豐富研究經驗及成果之各國研究單位，如挪威 STEP Group、德國歐洲經濟研究中心(ZEW)以及荷蘭來登大學科技研究中心（CWTS）等亦應保持聯繫，充分運用我國相關調查資料與研究，使科技統計資料研究能支援經濟發展與產業政策。

（四）此次考察行程中，挪威、德國等調查機構由經濟觀點認為創新調查結果應以滿足經濟分析之需求為目的，與法國、荷蘭崇尚務實，以能找出較精確，具統計意義的資訊為調查目標之作法，大異其趣。前者雖易流於好高騖遠，但對技術創新調查之後續發展極為重要。兩項觀點利弊參半，也是歐盟第三次調查問卷最大爭議所在，我國未來應以務實面著手，但創新研究之動向仍有必要繼續追蹤瞭解。

STEP group

Projects, funding and activities

STEP group

Studies in technology, innovation and economic policy
Studier i teknologi, innovasjon og økonomisk politikk

Storgaten 1, N-0155 Oslo, Norway Tlf + 47 22 47 73 10, Fax + 47 22 42 95 33

Studies in Technology, innovation and Economic Policy

STEP group

The STEP Group is a research institute working on the economic and social policy implications of a knowledge-based society. The group consists of fourteen full-time researchers and six research associates, based in Oslo, Norway. This note briefly describes the background and objectives of the STEP Group, then gives an overview of research areas, conference activities and publications.

INDEX OF CONTENT:

For full current details on STEP Group, including all publications, staff details, downloadable documents etc, please visit the STEP homepage at:

http://www.step.no

STEP Group in brief

The STEP Group was established in 1991 to support policy-makers with basic research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. STEP was initiated by the Royal Norwegian Council for Scientific and Industrial Research (NTNF), which since early 1993 has been a component of the new Research Council of Norway.

The primary objective of the group is to identify and to research core issues for innovation policy-makers. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth and social development. Yet the context of research, innovation and economic policies has changed sharply in recent years, and this new context presents new challenges.

The group has two forms of income: long-term core funding, and contract research income. In 1997 the group received 4.0 million NOK (approximately 500,000 ECU) from the Research Council of Norway, and approximately 7.0 million NOK from other contracting agencies.

At the beginning of 1991 the group consisted of two researchers. It now has fourteen full-time researchers and six research associates. The intention has been to build a group which has a broad disciplinary base, but which is integrated through an interest in innovation and technological change.

The group has strong quantitative skills: most of the research staff have competence in statistical analysis and computing. The STEP Group has placed strong emphasis on establishment and further development of data resources for policy analysis. The basic idea behind this is that policy-makers badly need improved statistics for policy decision-making. What is required is much better access to two different bodies of data. Firstly, *international* data, so that performance can be understood in a comparative perspective, and secondly, *national* data on R&D and innovation.

Background

The STEP Group was established in 1991 to support policy-makers with basic research on all aspects of innovation and technological change, with particular emphasis on the relationships between innovation, economic growth and the social context. STEP was initiated by the Royal Norwegian Council for Scientific and Industrial Research (NTNF), which since early 1993 has been a component of the new Research Council of Norway.

From 1991 to the end of 1993 the STEP Group was a section within the Norwegian Computing Centre. Since January 1994 it has been an independent foundation located in the centre of Oslo. STEP Group receives a core grant from the Strategy Department of the Research Council of Norway, and in addition works within a wide range of research programmes sponsored by the Council. STEP is a permanent contractor to the European Commission (DG-XIII, SPRINT Programme) and is currently carrying our four major research projects for the TSER Programme (DG-XII, Science, Research and Development) of the European Commission. In addition, STEP carries out contract research for a wide range of clients in both the public and private sectors.

Objectives and approach

The primary objective of the group is to identify and to research core issues for innovation policy-makers. The basis of the group's work is the recognition that science, technology and innovation are fundamental to economic growth and social development. Yet the context of research, innovation and economic policies has changed sharply in recent years, and this new context presents new challenges.

The new policy context results from a number of related technological and economic developments.

Firstly, there have been major scientific and technological changes, particularly in generic technologies such as IT, materials, and - most importantly - molecular biology and biotechnology.

Secondly, there have been profound changes in the economic policy environment - integration of capital markets, rapid growth in direct foreign investment, deregulation, and general internationalisation.

Thirdly, many countries have faced serious economic problems: persistent budget deficits and unemployment in the advanced economies, and continuing poverty and deprivation in much of the developing world.

Finally, environmental problems and constraints have become much more severe.

However there have also been significant shifts in our understanding of the relationships between science, technology and the social and economic world.

In the past, relationships between science and society have often been thought of in an oversimplified way. In particular, it has often been suggested that scientific discovery is a precondition for innovation, and that social and economic innovations are based primarily on research activity. Recent research has, however, emphasized the fact that knowledge creation and innovation are far more complex than this simple approach. Two results of modern research on science and innovation are particularly important. The first is that the creation of new technological knowledge may often involve research, but it is not necessarily *based* on research. The second is that the creation of knowledge, and the process of innovation (both in industry and the wider social system) involves *interaction and feedback* between different types of actors, and different social institutions. In particular, innovation does not result simply from a transfer of knowledge from the science system into applications.

At the same time, it is important not to think of technology as an autonomous process to which society must adapt. Understanding the dynamics of innovation means recognising that technologies are socially shaped, and that social and cultural choices powerfully influence the kinds of technologies which are developed, and the trajectories of technical advance.

Such insights have been the driving force of changed approaches to policy, especially at the European level (within the relevant Directorates of the European Commission), and the OECD.

These developments mean that policy-making has entered a new phase. On the one hand, science and technology policy can no longer be thought of purely in terms of *research* policy. That is, policy-makers are looking beyond research programmes which aim simply at the development of new scientific and technological principles and results. It is necessary to focus also on the interactive creation and use of science and technology, by companies and by society as a whole. This leads directly to a need to know more about the distribution of knowledge, and about the role of non-research factors in innovation processes.

At the same time there is at the present time an increasing emphasis on the social and economic relevance and impact of research, and on the factors which shape this impact. All of these considerations pose serious challenges for innovation policy-makers. The primary objective of the STEP Group is to explore the implications of these multi-faceted changes.

What kinds of approach are relevant to analysis of the policy challenges of the new economic and technological context? Our view is that technological change must be seen as endogenous to economic processes, as one component of the drive for competitive advantage by firms. In searching for new products and processes, firms are in effect introducing variety into the system, often in circumstances of great

turbulence and uncertainty. This introduces an evolutionary element into economic dynamics, and the group therefore takes a broadly evolutionary perspective on economic change. At the same time, it is clear that firms rarely innovate in isolation; on the contrary, they work within complex networks or systems of knowledge creation, which include universities, research institutes, regulatory bodies, and other public agencies. We therefore tend to take a systemic view of innovation, which makes no sharp distinction between public and private, but which focuses on the scope and characteristics of public-private interactions. This means that members of STEP tend to approach problems of the creation of technology from a framework which strongly emphasises the social and economic context of innovation as a basic determinant of both the direction and content of innovation.

Funding

The group has two forms of income: long-term core funding, and contract research income. In 1997 the group received 4.0 million NOK (approximately 500,000 ECU) from the Research Council of Norway, and approximately 7.0 million NOK from other contracting agencies. The most important of these are the Regional Affairs Ministry, and the European Commission. The total group budget is thus 11 million NOK, or approximately 1.5 million ECU. In 1997 the group had a net operating surplus of approximately 750,000 NOK, or 90,000 ECU.

STEP Group project areas and activities 1998

Our main project areas at the present time are:

i. International comparisons of R&D and innovation performance in manufacturing

This project area uses the OECD STAN and ANBERD databases, and the Community Innovation Survey database, to produce analytical indicators comparing R&D and innovation performance. This project is producing general comparative papers for the advanced economies as a whole, as well as specific analyses which put Norway's performance into the context of general small economies. We have recently completed major projects on innovation expenditures in European industry, and on innovation in the European pulp and paper industry.

ii. R&D and innovation in Norwegian industry: structure and trends

This project area has several main elements. Firstly, a detailed disaggregated study of company-level R&D and innovation in Norwegian industry from 1980 using micro-level data. Secondly, detailed micro-level analyses of innovation at company level in Norway, focusing especially on SMEs. This R&D and innovation data has been linked with accounting data for the companies concerned, in collaboration with the Central

Statistical Bureau. This is enabling us to look in detail at the links between innovation and profitability at firm level in Norway.

iii. Mapping the Norwegian system of knowledge production

This project is an ambitious attempt to produce a quantitative overview of the main institutions and resources which develop economically-relevant knowledge in Norway. It is an attempt to describe and quantify the national system of innovation with a particular focus on knowledge creation and distribution. The project uses an extremely wide range of data sources, and will result in a book.

iv. Development and Analysis of Innovation Indicators

The STEP Group has played an active role in the development of new indicators related to innovation activities and outputs. Our view is that the main existing data sources - namely R&D, patent and bibliometric data - have serious limitations when it comes to the analysis of innovation in industry (particularly in so-called 'low technology' sectors). This work continues, especially around the so-called IDEA project ('Indicators and Data for European Analysis') for the European Commission.

v. Regional innovation systems and policy

This project area, which is one of the biggest within the group, studies a range of theoretical and empirical issues related to regional growth, with particular emphasis on regional inter-firm linkages and the role of regional science and technology infrastructures. Theoretical studies are focusing on the conceptualisation of 'regional innovation systems' and regional networks. Empirical studies include detailed analysis of innovation activity at regional level, studies of the technological evolution of key regional industries, and studies of regional policy instruments.

vi. Skills, qualifications and mobility in the Norwegian system

One of the major economic impacts of technological change occurs via the diffusion of technological knowledge, and this occurs through formal processes (such as patenting and licensing), but also through informal processes (such as knowledge exchange). One of the most important mechanisms for the spread of knowledge is personnel mobility between different institutions and firms; this is likely to be one of the most important ways in which the public science and technology infrastructure has economic effects. The STEP Group has carried out several quantitative studies of mobility in the Norwegian system, focusing on knowledge-exchange between the three major research-performing sectors of the Norwegian economy - business, universities and the institute sector. We have now developed this further by using the

'AA register', an extremely large database of skills and qualifications in the Norwegian workforce to map skills and mobility across all sectors, regions and firm-size-classes in Norway. A substantial report on mobility in the Nordic area as a whole has recently been completed.

vii. R&D and technological change in service industries

One of the key trends in the post-war economy has been structural change involving growth of the service sector. However public-sector research policies, in all advanced countries, are overwhelmingly concentrated on two research-performing sectors: manufacturing industry, and the university sector. From both economic and social point of view, this focus is very problematical, because it is not obvious that these sectors are in fact central either to economic performance, or to social welfare, or to the development of new forms of knowledge. In quantitative terms (measured either in terms of output or employment), by far the largest sectors in all OECD economies are *private services* (such as transport or finance) and *public services* (such as health and education). Both public and private services contain activities which both use technology intensively, and also create innovative technologies. In our view the role of these sectors in the creation and diffusion of new technologies is seriously neglected in research policies at the present time. Within the STEP Group this project area involves studies of economic dimensions and technological characteristics of service activities in the Norwegian economy. STEP is carrying our work for the Research Council of Norway on this issue. In addition, the SI4S project, which is one of our TSER projects for the European Commission involves a very substantial amount of work on all aspects of the services economy in Europe.

viii. Corporate governance and innovation performance

The objective of this project is to analyse the role of 'corporate governance' in shaping the innovation and growth performance of firms and countries. The project has an international and comparative perspective.

We define corporate governance as the general system of policies and regulations by which companies are owned, directed and controlled. These differences - in regulation systems, ownership and control structures, tax policies, financial systems and so on - play a central role in determining differences in the long-term innovation capabilities of firms. The basic hypotheses of this project are

- That there remain major differences in corporate governance systems among European economies (both large and small), and between European economies, the USA, and Japan.
- That differences in corporate governance structures are central in explaining innovative differences, and differences in the ability to exploit technological opportunities.

- That the corporate governance-innovation link is increasingly important for policy-makers, particularly in the fields of industrial policy and technology policy.

The objective of the project is to test these hypotheses with empirical studies of governance systems at national and industry level, and to identify the key policy implications for European-level industrial policy.

ix. Innovation, clusters and globalisation

Globalisation is now a central aspect of innovation and technology creation. While recent theories of trade and economic growth recognise the central importance of innovation and technological change in shaping competitive advantage and income growth, linking the analysis of international economic relations and growth to richer models of innovation remains a challenge. New insight can best be obtained by combining micro-oriented studies of firm technology with analysis of international specialisation based on new theories of economic growth and economic geography. Industrial clusters can be supported by technological differences and externalities as well as resource-based comparative advantage or market-related externalities (as suggested by recent theories of economic geography). The project therefore aims at analysing alternative explanations of industrial clusters and their development over time, as well as the linkages between technology, factor endowments and market structure. It is a joint project with the ESST programme, University of Oslo, and NUPI, Oslo.

STEP Group Organization

At the beginning of 1991 the group consisted of two researchers. It now has fourteen full-time researchers and six research associates. The intention has been to build a group which has a broad disciplinary base, but which is integrated through an interest in innovation and technological change. The group has strong quantitative skills: most have competence in statistical analysis and computing. In what follows, the abbreviation "STS" refers to members of staff with specific post-graduate training and qualifications in Science and Technology Studies. The members of the group are:

Professor Keith Smith, Director (Economist)

Principal Researchers:

Thor Egil Braadland (Geographer)
Anders Ekeland (Economist)
Johan Hauknes (Physicist/Policy analyst)
Arne Isaksen (Geographer)
Erik Iversen (STS/Classical Studies)
Rajneesh Narula (Economist; joint appointment with ESST programme)

Inger Nesheim (Librarian)
Svein Olav Nås (Economist)
Trond Einar Pedersen (STS/Sociology)
Hanne Rønne (Office Manager)
Tore Sandven (Sociologist)
Nils Henrik Solum (STS/Historian)
Morten Staude (Economist; currently on secondment to Research Council of Norway)
Heidi Wiig (Political scientist)
Finn Ørstavik (Sociologist)

The STEP Group also has six research associates, who work with the group on a part-time basis. These are:

Professor Bjørn Asheim, University of Oslo
Professor William Lazonick, University of Massachusetts
Dr Mary O'Sullivan, INSEAD, Fontainbleu
Dr Svend Otto Remøe
Professor Giorgio Sirilli, National Research Council of Italy
Professor Morris Teubal, Centre for Industrial Development, Hebrew University of Jerusalem

A quantitative approach

The STEP Group has placed strong emphasis on establishment and further development of data resources for policy analysis. The basic idea behind this is that policy-makers badly need improved statistics for policy decision-making. What is required is much better access to two different bodies of data. Firstly, *international* data, so that performance can be understood in a comparative perspective, and secondly, *national* data on R&D and innovation.

In our view the most important international data sets are the so-called STAN and ANBERD databases, which have been developed by the Economic Analysis and Statistics Division of the OECD over the past four years, and the CIS database (*Community Innovation Survey*) developed by EUROSTAT and DG-XIII (SPRINT Programme, European Innovation Monitoring Initiative) for the European Commission.

The STAN (Structural Analysis) database integrates - in a consistent way - data on industrial output, labour costs, exports and imports, and investment. ANBERD (Analytical Business Expenditure on R&D) is an R&D database compatible with STAN. The group has used these datasets extensively. The group has also established the OECD National Accounts database, the Business Sector database, and the Science and Technology Indicators Database.

The group also maintains large datasets related to the Norwegian economy. Until relatively recently Norwegian industrial R&D data has not been held in accessible machine-readable form; a database has now been developed which resolves this problem for the 1980s. The group runs the Central Statistical Bureau datasets on R&D and industrial innovation, as well as datasets on the service sector; all these datasets are highly disaggregated. The group has built a database on publicly funded industrial R&D (especially through the Research Council of Norway), 1950 - 1990, based on consistent scientific and technological classifications. The STEP Group also holds databases on innovation activity in the Norwegian manufacturing sector (1989-90.

The group has close links with the development of the *Community Innovation Survey* (CIS) dataset, and is working on projects with it. Keith Smith is consultant to this joint DG-XIII/Eurostat initiative, which springs out of earlier OECD work, noted above, to develop a conceptually consistent and workable approach to the collection of data on innovation-related activities and outputs of product innovations. The group has used this dataset in collaborative projects, with the National Research Council of Italy, and the Technical University of Helsinki.

Contract research

The STEP Group has recently undertaken external commissioned research projects - all within the areas of science, technology and higher education policy - for the Norwegian Ministries of Industry, Education and Research, Oil and Energy, and Social Affairs; for the Confederation of Norwegian Industry (NHO); for Hafslund Nycomed AS; for Telenor; for EUROSTAT; and for the European Commission.

Teaching and university links

The STEP Group has links with several university teaching activities. Perhaps the most important of these is the ESST programme (Education in Society, Science and Technology) at the University of Oslo. ESST is a collaborative Masters degree in Science and Technology Studies, currently being taught simultaneously in seven European universities. Five members of the STEP Group are involved in teaching on the ESST programme, and since 1994 STEP members have supervised 15 theses of students on this programme.

In addition, Keith Smith is a Professor in the Institute for Economics, Norwegian University of Science and Technology (NTNU), Trondheim, teaching industrial economics and the economics of technological change.

Non-research services

The STEP Group provides a wide range of informal services for people working in the fields of science, technology and innovation policy. We receive many requests for assistance with data, information, or other material. This type of activity has ranged, over the past year, from requests from journalists for statistical help, to requests from embassies for information on Norwegian R&D and innovation, to requests from Government ministers for advice. Most of this activity is logged by the group in a purpose designed database; each year we have approximately 250 such requests, and use approximately 900 hours of our time in responding to such requests. The STEP homepage on the Worldwide Web currently averages about 100 external visitors per week.

STEP group

STUDIES IN TECHNOLOGY, INNOVATION AND ECONOMIC POLICY

STEP Group publications: Report overview

1994

1/94 New directions in research and technology policy: Identifying the key issues
2/94 FoU i norsk næringsliv 1985-1991
3/94 Competitiveness and its predecessors – a 500-year cross-national perspective
4/94 Innovasjon og ny teknologi i norsk industri: En oversikt
5/94 Forskermobilitet i næringslivet i 1992
6/94 Naturviternes kontakt med andre sektorer i samfunnet
7/94 Forsknings- og teknologisamarbeid i norsk industri
8/94 Forskermobilitet i instituttsektoren i 1992
9/94 Modelling the mobility of researchers
10/94 Interactions in knowledge systems: Foundations, policy implications and empirical methods
11/94 Tjenestesektoren i det økonomiske helhetsbildet
12/94 Recent trends in economic theory – implications for development geography
13/94 Tjenesteytende næringer – økonomi og teknologi
14/94 Teknologipolitikk i det norske statsbudsjettet
15/94 A Schumpeterian theory of underdevelopment – a contradiction in terms?
16/94 Understanding R&D performance: A note on a new OECD indicator
17/94 Norsk fiskeriteknologi – politiske mål i møte med regionale kulturer
18/94 Regionale innovasjonssystem: Teknologipolitikk som regionalpolitikk
19/94 Hvorfor er økonomisk vekst geografisk ujevnt fordelt?
20/94 Creating and extracting value: Corporate investment behaviour and economic performance
21/94 Entreprenørskap i Møre og Romsdal. Et historisk perspektiv
22/94 Fiskerinæringens teknologi og dens regionale forankring
23/94 Skill formation in wealthy nations: Organizational evolution and economic consequences

1995

1/95 What comprises a regional innovation system? An empirical study
2/95 Adopting a 'high-tech' policy in a 'low-tech' industry. The case of aquaculture
3/95 Industrial Districts as 'learning regions'. A condition for prosperity
4/95 Mot en regional innovasjonspolitikk for Norge

1996

1/96 Nyskapning og teknologiutvikling i Nord-Norge. Evaluering av NT programmet
2/96 How innovative is Norwegian industry? An international comparison
3/96 Location and innovation. Geographical variations in innovative activity in Norwegian manufacturing industry
4/96 Typologies of innovation in small and medium sized enterprises in Norway
5/96 Innovation outputs in the Norwegian economy: How innovative are small firms and medium sized enterprises in Norway
6/96 Services in European Innovation Systems: A review of issues
7/96 Innovation in the Service Economy
8/96 Endring i telekommunikasjon - utfordringer for Norge
9/96 An empirical study of the innovation system in Finmark
10/96 Technology acquisition by SME's in Norway
11/96 Innovation Policies for SMEs in Norway
12/96 Design and Innovation in Norwegian Industry
13/96 Location, agglomeration and innovation: Towards regional innovation systems in Norway?
14/96 Sustained Economic Development
15/96 Postens stilling i det globale informasjonsamfunnet: et eksplorativt studium
16/96 Regional Clusters and Competitiveness: the Norwegian Case

1997

1/97 Innovation, firm profitability and growth
2/97 Innovation policies for SMEs in Norway: Analytical framework and policy options
3/97 Regional innovasjon: En ny strategi i tiltaksarbeid og regionalpolitikk
4/97 Innovation Activities in Pulp, Paper and Paper Products in Europe
5/97 Innovation Expenditures in European Industry

1998

1/98 **Regionalisation and regional clusters as development strategies in a global economy**
2/98 **Innovation in ultra-pheripheral regions: the case of Finnmark and rural areas in Norway**
3/98 **Corporate Governance and the Innovative Economy: Policy Implications**
4/98 **Strategic technology alliances by European firms since 1980: questioning integration?**
5/98 **Innovation through strategic alliances: moving towards international partnerships and contractual agreements**
6/98 **Formal competencies in the innovation systems of the Nordic countries: An analysis based on register data**
7/98 **Det internasjonale erfaringsgrunnlaget for teknologi- og innovasjonspolitikk: Relevante implikasjoner for Norge**
8/98 **Innovasjon i Norge - en statusrapport**
9/98 **Innovation regimes and trajectoris in goods transport**
10/98 **Struktur og dynamikk i kunnskapsbaserte næringer i Oslo**
11/98 **Grunnforskning og økonomisk vekst: Ikke-instrumentell kunnskap**
12/98 **Dynamic innovation systems: Do services have a role to play?**
13/98 **Services in Innovation – Innovation in Services**
14/98 **Information and communication technology in international policy discussions**
15/98 **Norwegian Input-Output Clusters and Innovation Patterns**

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This list includes books, articles in referee journals, articles in policy journals, and articles in scholarly books, published in recent years by STEP researchers and STEP research associates. In the case of research associates, we include only publications connected with their work at STEP.

This list does not include newspaper or magazine articles, working papers, notes, occasional publications, and so on.

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Evaluation of STEP Group

STEP was established in 1991 as one element of a research programme called "Future-Oriented Technology Policy" or "FREMTEK", which was sponsored by the Royal Norwegian Council for Scientific and Industrial Research (NTNF). A core grant to STEP was the largest single element of the FREMTEK programme, and thus an evaluation of STEP was a key part of the final evaluation of FREMTEK.

This evaluation was carried out in 1994 by Mr Erkki Ormala, of the Science and Technology Policy Council of Finland, and by Mr Göran Friborg, of NUTEK in Stockholm. The evaluators began by outlining the main problems faced, in their view, by modern policy-makers:

"Modern innovation or technology policy planning is aimed at developing an efficient and effective national innovation system and at integrating its development into planning and decision-making in other relevant policy sectors like economic policy, education policy and industrial policy ... Policy planners and decision makers need research data about international trends as well as on national developments and conditions. Innovation policy studies should explore the capacity of the national system to produce new relevant knowledge to the benefit of economic and social development. On the other hand it is important, in small countries in particular, to examine the diffusion and exploitation capacity of the national actors both in industry and public sector."

Against this background the evaluators concluded that *"The selected research areas of the STEP Group address important issues in all of these dimensions"*. The individual research areas were discussed in detail, with the STEP work on innovation indicators being singled out as a particular achievement:

"The STEP Groups contribution to research on the development and analysis of innovation indicators represents, without any doubt, a forefront research internationally. The results achieved in these studies are applied widely in many countries as well as in international organizations such as the EU and the OECD. This work has helped to increase significantly our understanding of preconditions and patterns of innovation in industry. For its contribution, the STEP Group is known throughout the world."

The evaluators suggested a number of areas where the STEP Group could extend and improve its work, such as technology foresight, environment, and education and skill requirements. The main criticism raised by the evaluators was that *"the knowledge produced by the group is not sufficiently disseminated and exploited"*, and they suggested a need for sharper policy conclusions to STEP reports. On the other hand, they noted that *"dissemination and exploitation problems cannot be solved by the STEP Group alone. If the absorbtive capacity of the relevant administrations and industry is not sufficient, researchers have only limited possibilities to compensate these shortcomings."*

Stiftelsen Studies in Technology, Innovation and Economic Policy (STEP)

(Est. 10th January 1994)

Objectives

STEP is a non-profit foundation aiming at the furthering and performance of research, analysis, documentation and other diffusion of knowledge giving enhanced insight and understanding of the role of knowledge and technology in modern society.

STEP shall ... establish a wide-ranging base of competencies and capabilities to answer the needs of a broad knowledge base for public science and innovation policy.

STEP shall ... establish a basis for strategic decision making in public agencies and authorities with responsibility for trans-national, national and regional policy making in these areas.

STEP group

STEP Project areas

i) Innovation in Norwegian industries: Performance, structure and trends

ii) Mapping the Norwegian system of knowledge production and diffusion

iii) Development and analysis of innovation indicators

iv) Regional innovation systems and policy

v) Skills, qualifications and labour mobility in the Norwegian system

vi) Services in national innovation systems

vii) Analysis of innovation and technology policy developments

viii) Science, technology and economic growth

STEP group

Short history

NTNF Fremtidsrettet teknologipolitikk 1990-1993

supporting the strategy process of NTNF – the Norwegian council of Industrial and Technological Research

TPOL, Norsk Regnesentral

1990-1993

Stiftelsen STEP established 1994

supported by Norges forskningsråd – the Research Council of Norway

5 yr strategic program 1994-1998 Research on innovation, industrial development and innovation policies

Strategic Agreement 1999-2001 with Norges forskningsråd on the development of a national knowledge base of industrial research and innovation policies

STEP is recognised as a core institution supporting national innovation policy making by the Ministry of Industry, Ministry of Regional Affairs and the Finance Ministry

STEP group

Important collaborators

ESST, University of Oslo
FAFO, Oslo
NTNU/Institute of Economics, Trondheim
NIFU, Oslo
SINTEF Innovation management, Trondheim

CNR/ISTAT, Rome
CNRS/BETA, Strasbourg
IKE, Aalborg
MERIT, Maastricht
NUTEK, Stockholm
PREST, Manchester
Roskilde UniversitetsCenter, Roskilde
SPRU & CENTRIM, Brighton
Technopolis, Brighton
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Permanent contractors to DG-13, European Commission

Consultants to OECD (DSTI)

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STEP Researchers

20 researchers, e.g.

- **6 economists**
- **2 sociologists**
- **4 economic geographers**
- **3 historians**

Main funders

Norges forskningsråd

European Commission

Ministry of Regional Affairs

STEP group

Major projects 2000

Corporate Governance and European Performance CGEP, project leader KSM

Innovation services in the Service Economy RISE, project leader JOH

Profit and innovation, project leader SON

SIVA – National centre for incubators and technology parks, evaluation, project leader AIS

SND – the State Fund for Industrial and Regional Development, evaluation, project leader KSM/JOH

IFU/OFU – Industrial and Public procurement and development, evaluation, project leader MOS

OECD National Innovation Systems , project leader JOH, AEK, FOE

Regionale profiler M&R, project leader SON

Hovedstadsområdets rolle for nasjonal nyskaping, project leader AIS

Labour mobility and human capital, project leader AEK

Assessing the economic impact of IT, project leader KSM

STEP group

The Mannheim Innovation Panels (MIP and MIP–S) of the Centre for European Economic Research (ZEW)

forthcoming in: Schmollers Jahrbuch

Norbert Janz, Günther Ebling, Sandra Gottschalk
and Hiltrud Niggemann[1]
ZEW Mannheim

1 Introduction

In 1992, the Centre for European Economic Research (ZEW)[2] was assigned by the German government to conduct an innovation survey representative for the German manufacturing sector leading to international comparable data on the innovation behaviour of German firms. The resulting first wave of the Mannheim Innovation Panel (MIP) entitled as "Prospects of the German Economy" (in German: "Zukunftsperspektiven der deutschen Wirtschaft") was carried out in 1993 as the German part of the first European wide Community Innovation Surveys (CIS) coordinated by Eurostat. Harhoff and Licht (1994) as well as Licht and Stahl (1994) give more detailed information on the first wave of the MIP.

In 1995, the growing importance of service sector industries for the German economy led to a separate, but very closely related innovation survey, the Mannheim Innovation Panel in the Service Sector (MIP–S), entitled as "Services in the Future" (in German: "Dienstleistungen in der Zukunft"). In 1997, this time both surveys were the German part of the second European CIS (CIS 2). Both surveys, MIP as well as MIP–S, are financed by the German federal ministry of education and research (BMBF). Most of the task of the field work is delegated to infas Institute for Applied Social Science at Bonn. MIP–S is cooperative work of ZEW and Fraunhofer–Institute for Systems and Innovation Research (ISI) at Karlsruhe. The quality of the work done is monitored

[1]The authors thank Georg Licht and Joachim Wagner for helpful comments.

[2]For further information see http://www.zew.de.

by a scientific advisory board.[3]

To ensure international comparable data on innovation activities, the survey methodology of MIP and MIP–S is strongly related to the proposed guidelines documented in the OECD/Eurostat Oslo–Manual on innovation statistics (OECD/Eurostat, 1997). Both, the MIP and the MIP–S surveys are designed as panels to ensure intertemporal comparability and to allow analyses of innovation dynamics at firm level.

The paper is organized as follows: Section 2 gives more detailed information on the survey methodology, i.e. survey population, sample and response. Section 3 summarizes the main information on the basic definitions of innovation and innovative firms as well as the collected variables. Examples of recent research using MIP and MIP–S are given in section 4. Information on data access to MIP and MIP–S are contained in section 5.

2 Survey Methodology

The target population of the MIP covers legally independent German firms with at least 5 employees from the sectors mining and quarrying, manufacturing, electricity, gas and water supply as well as construction (NACE classes, 10 14, 15–37, 40–41 and 45, respectively).[4] Selected service sector industries were covered in the first 2 waves before the MIP–S started in 1995. MIP–S covers German firms with at least 5 employees from business related and distribution service sector industries, i.e. the branches wholesale and retail trade, transportation, storage and communication, as well as financial intermediation, real estate, renting and business activities, sewage and refuse disposal

[3]The members of the advisory board currently are: H.G. Gemünden (chairman, University of Technology, Berlin), P. Brügger (Federal Statistical Office), H. Grupp (ISI, Karlsruhe), D. Harhoff (University of Munich), S. Krebs (VDMA German Machinery and Plant Manufacturing Industry Federation), H. Legler (NIW Lower Saxony Institute of Economic Research), G. Ronning (University of Tübingen) and G. Sandermann (Federal Ministry of Economics and Technology).

[4]NACE (Nomenclature générale des activités économique dans le Communautés européennes) as published by Eurostat.

(NACE classes 50–52, 60–64, 65–67, 70–74, 90, respectively). Public services and most of the consumer related services are excluded.

In contrast to most other European countries, in Germany there is no business register. Therefore, other databases have to serve as sampling frames. MIP and MIP–S use the database of Germany's most important credit rating agency Creditreform to construct the frame population from which the sample is drawn.[5] The samples of MIP and MIP–S are drawn as stratified random samples. Firm size (8 size classes according to the number of employees in MIP and 7 in MIP–S), branch of industry (mostly according to 2–digit NACE classes) and region (East and West Germany) are used as stratifying variables.

Both surveys are designed as panels, e.g. the questionnaire is sent to the same set of firms every year, with the exception of firm exits. Additionally, the sample is refreshed every second year by a stratified random sample of newly founded firms and other firms that moved into the frame population, e.g. because of changes in the branch of industry or firm growth to at least 5 employees. The sampling is disproportional, i.e. the sampling probabilities vary between cells: Large firms, firms from East Germany and firms from heterogeneous cells according to labour productivity are oversampled.

Since 1998, the sampling scheme differs slightly every second year for cost reasons. In the even years, a shortened questionnaire is sent to the sub–sample of firms which have answered the questionnaire at least once or which have been added to the sample in the preceding year. The full sample is used every odd year. Additionally, the most relevant variables are asked retrospectively for the preceding even year to maintain the panel structure with yearly waves.

MIP and MIP–S are voluntary mail surveys. The questionnaire is usually sent to the sampled firms in early spring with two mail reminders in late spring and early summer. Additionally, selected firms are phoned. In 1999, 10,557 and 11,737 firms were sampled in MIP and MIP–S respectively. 2,502 responded in MIP and 2,418 in MIP–S. This corresponds to response rates of 23.7% and 20.6%. On average about 2,000 to 2,500 firms have responded in the surveys. A telephone non–response survey with 1,000 realised interviews is carried out

[5]See Licht and Stahl (1994) and Ahmus et al. (2000) for detailed information on the Creditreform database.

in both surveys in autumn to check for a possible non–response bias in the variables of main interest. Expansion factors corrected for non-response bias are available for single cross–sections.[6]

3 Surveyed Information

The Oslo–manual (OECD/Eurostat, 1997) developed by OECD and Eurostat and first published in 1992 serves as the methodological basis for the European CIS as well as the German MIP and MIP–S. It gives basic definitions of product and process innovations, innovation activities and components of innovation expenditure related to these activities. The notion of innovation in the Oslo–manual focuses on three aspects of innovation: The innovation should be technology oriented, i.e. based on (technologically) new knowledge. It should be implemented, i.e. either introduced onto the market (product innovation) or used within the production process (process innovation). The products (including services) and processes should be new or significantly improved to the firm, they do not have to be new to the market, economy or world. Thus, innovation according to the Oslo- manual does include diffusion of innovation which can be seen as imitation activities. An innovative firm is a firm which has implemented at least on innovation within the last three years.

Innovation expenditure includes expenditure for finished, abandoned, and ongoing innovation projects. According to this, non–innovative firms can have innovation expenditure. Innovation expenditure comprises all current expenditure (personnel, materials, services, etc.) as well as capital expenditure for innovation. Innovation expenditure is in particular R&D expenditure[7], expenditure for machinery and materials, expenditure for the acquisition of external knowledge (patents, not patented inventions and licenses), expenditure for product design and production preparations, expenditure for training of employees, expenditure for market tests and market introductions if these activities are directly related to innovation projects.

[6] More detailed information on the survey methodology is available in Janz et al. (2000).

[7] The definition of R&D according to OECD (1994) used in official R&D statistics is explicitly nested in the definition of innovation.

In addition to the innovation related variables — product innovation, process innovations, innovation expenditure — most of the quantitative variables are available for every firm in every year. These are especially: number of employees, sales and exports (not for financial services within MIP–S), total wage costs, training costs (only MIP–S), material costs (only MIP), capital expenditure, stock of capital (only MIP), expenditure for investments in IT–capital (only MIP–S) and skill structure on four different levels.

Additional variables are available for firms having innovative activities: R&D–expenditure, R&D–personnel (only MIP), share of sales with product innovations, share of sales with market novelties and share of cost reduction due to process innovations.

More detailed information on special topics of innovation behaviour and other fields of interest are only available for some years, sometimes only for single cross–sections. These are for example: factors hampering innovation activities, objectives of innovations, cooperation activities related to innovation activities, patenting activities, usage of different technologies, sources of information for innovation activities etc. Most of these variables are of qualitative nature. For more detailed information on the availability of variables in single cross–sections see Janz et al. (2000).

4 Recent Research

Different topics have been tackled using MIP and MIP–S data. These can broadly be grouped into three categories: innovation and employment, innovation and firm strategies, and innovation and technology policy. In the following we present some selected examples for research in these fields.

Papers within the first category deal especially with the effects of innovation activities on labour demand. Labour quite often is modelled heterogeneously to allow for different effects on differing skill groups. Falk and Seim (2000) investigate the impact of information technology on high–skilled labour in services using panel data from the MIP–S. They estimate labour demand functions using Random– and Fixed–Effect–Tobit–Models. They find a positive,

but surprisingly small effect of IT-investment to sales ratio on the share of high-skilled workers.

Incorporated within the second topic are aspects of internationalisation (e.g. exports), environmental activities, patenting and firm cooperation. Ebling and Janz (1999) analyse the interrelation between innovation and export activities of services sector companies within a simultaneous equation framework for discrete variables. They find a significantly positive impact of innovation on exports, but no effect from exports on innovation. The locational choice of patenting activities is theoretically and empirically investigated by Inkmann et al. (2000). For German manufacturing firms, traditional determinants of international trade flows only have limited impact on patenting abroad. Using a game theoretic approach, Kaiser (2000) analyses cooperation activities of German service sector firms. Cooperation only has weak effects on innovation expenditure.

More political questions, like the effects of technology policy on the appropriability of technical knowledge and aspects of technological diffusion are summarized in category three. Beise and Stahl (1999) deal with the effects of publicly funded research in universities, polytechnics and federal research labs on industrial innovations in Germany. They find that less than one tenth of innovating firms are directly dependent on results of publicly funded research.

The ZEW annually reports indicators on innovation activities expanded to the population of German firms to the German government (see Ebling et al., 2000a and 2000b). They form an important input to the annual reports on Germany's technological performance published by the German government (see Legler et al., 2000).

5 Data Access

Single cross-sections of MIP and MIP-S are freely available in anonymized form as public use files for purely non-commercial basic research. After signing a contract in which research project and project members are specified the data are sent by e-mail or on floppy disk in various data styles. It is not possible to use the data for teaching purposes.

Different methods are used to prevent single firms from being identified: All variables measured in money amounts are only available as ratios to sales or employees and additionally are made anonymous using the disguised random factor method, i.e. these variables are multiplied by a firm specific unique random factor which is uniformly distributed on the interval $[0.5; 1.5]$. The factor is constant across waves for a given firm. Very large values of some variables are censored from the right. Moreover, some variables representing shares in sales or employees are grouped. Some very large conglomerates which nevertheless could be identified quite easily are removed from the data set.

Researchers having experience with the public use file are given the opportunity to work with the original data within the rooms of the ZEW. About 40 research groups outside ZEW have signed contracts for the public use files and about ten have used the data within ZEW. In spring 2000, the first MIP user conference took place in Mannheim with about 50 participants. It is planned to establish the user conference every second year.

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