

# 科技部補助專題研究計畫成果報告 期末報告

## 我國人因工程二十年之論文發表主題調查與分析

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中華民國 103 年 08 月 04 日

中文摘要： 中華民國人因工程學會自 1993 年成立迄今已快屆滿二十周年，這些年來國內人因工程相關研究的議題演變，以及與國際間研究趨勢的相關性，即為本計畫主要的研究目的。本研究蒐集了 113 位學會永久會員，共 2,584 篇的期刊論文清單，初步分析後發現論文發表總數前三名的國內外期刊分別為工業工程學刊、勞工安全衛生研究季刊、人因工程學刊、International Journal of Industrial Ergonomics、Perceptual and Motor Skills、Applied Ergonomics 等六種。接著以 19 項主題與五個時期(1992 年以前、1993~1997 年、1998~2002 年、2003~2007 年、2007~2012 年)分析每一篇論文，結果與人因工程較為相關的論文數只有 1,451 篇(56%)，篇數最多的主題是「產品或場所之評估與設計類」，但整體排名為第五(前四名為醫學或復健類、設計理論與方法類、生管或品管類、其他類)。進一步針對人因工程相關論文在各時期發表的情形來分析，結果發現從 1993 年開始，每五年以均 100 篇的速度在增加，其中論文篇數呈現正成長的主題有「人機介面」、「職業安全與衛生」、「特定職場之研究」、「特定族群之研究」、「系統建置與評估」、「駕駛作業」、「巨觀人因」等七項，但「人因理論」與「檢驗作業」二項主題的論文篇數呈現負成長。論文主題從早期的人因工程評估方法等基礎研究，後來偏重於職業安全與衛生，以及近年的人機介面，這每個主題均與國際間的熱門議題具有高度關聯性。未來，本國人因工程建議可多著力於認知人因工程(縮短服務業從業人員能力與工作需求之間的差距)、組織人因工程(協助企業得以快速調整組織來因應市場需求)以及保健(人口老化的影響)等相關議題上，以期人因工程能夠持續在國內各行各業中發揚與光大。

中文關鍵詞： 人因工程、趨勢分析、論文主題、研究發表

英文摘要： The Ergonomics Society of Taiwan will celebrate its 20th anniversary in 2013. The study looked into the development of Ergonomics in Taiwan by analyzing 1,404 papers published by 113 lifetime members of the Ergonomics Society of Taiwan. The authors examined each essay by key words and context of abstracts and coded along period of publication (1971-1992(1st Period), 1993-1997(2nd Period), 1998-2002(3rd Period), 2003-2007(4th Period), and 2008-2012(5th Period)), and 13 topic categories. The results show that the publication has an increase of about 100 essays every five years since 1993. The most popular

topic was Ergonomic Assessment and Analysis Techniques in 1st Period, Force Exertion Related Research in 2nd Period, Product Design and Evaluation in 3rd Period, Occupational Safety and Health in 4th Period, and Human-Computer Interface in 5th Period. Moreover, the numbers of essay about Occupational Safety and Health, and Human-Computer Interface, Specific Workplace Related Research, Specific User Group Research, System Development and Evaluation, Driving Related Research, and Micro-ergonomics were increased period by period. However, the quantity of essays about Ergonomics Theory and Inspection Related Research were decreased. The results of this study will help to predict the future direction of Taiwan ergonomic research effort for the next 20 years.

英文關鍵詞： ergonomic, trend analysis, research papers, publication.

## 中文摘要

中華民國人因工程學會自 1993 年成立迄今已快屆滿二十周年，這些年來國內人因工程相關研究的議題演變，以及與國際間研究趨勢的相關性，即為本計畫主要的研究目的。本研究蒐集了 113 位學會永久會員，共 2,584 篇的期刊論文清單，初步分析後發現論文發表總數前三名的國內外期刊分別為工業工程學刊、勞工安全衛生研究季刊、人因工程學刊、International Journal of Industrial Ergonomics、Perceptual and Motor Skills、Applied Ergonomics 等六種。接著以 19 項主題與五個時期(1992 年以前、1993~1997 年、1998~2002 年、2003~2007 年、2007~2012 年)分析每一篇論文，結果與人因工程較為相關的論文數只有 1,451 篇(56%)，篇數最多的主題是「產品或場所之評估與設計類」，但整體排名為第五(前四名為醫學或復健類、設計理論與方法類、生管或品管類、其他類)。進一步針對人因工程相關論文在各時期發表的情形來分析，結果發現從 1993 年開始，每五年以均 100 篇的速度在增加，其中論文篇數呈現正成長的主題有「人機介面」、「職業安全與衛生」、「特定職場之研究」、「特定族群之研究」、「系統建置與評估」、「駕駛作業」、「巨觀人因」等七項，但「人因理論」與「檢驗作業」二項主題的論文篇數呈現負成長。論文主題從早期的人因工程評估方法等基礎研究，後來偏重於職業安全與衛生，以及近年的人機介面，這每個主題均與國際間的熱門議題具有高度關聯性。未來，本國人因工程建議可多著力於認知人因工程(縮短服務業從業人員能力與工作需求之間的差距)、組織人因工程(協助企業得以快速調整組織來因應市場需求)以及保健(人口老化的影響)等相關議題上，以期人因工程能夠持續在國內各行各業中發揚與光大。

**中文關鍵詞：**人因工程、趨勢分析、論文主題、研究發表

## **Abstract**

The Ergonomics Society of Taiwan will celebrate its 20th anniversary in 2013. The study looked into the development of Ergonomics in Taiwan by analyzing 1,404 papers published by 113 lifetime members of the Ergonomics Society of Taiwan. The authors examined each essay by key words and context of abstracts and coded along period of publication (1971-1992(1st Period), 1993-1997(2nd Period), 1998-2002(3rd Period), 2003-2007(4th Period), and 2008-2012(5th Period)), and 13 topic categories. The results show that the publication has an increase of about 100 essays every five years since 1993. The most popular topic was Ergonomic Assessment and Analysis Techniques in 1st Period, Force Exertion Related Research in 2nd Period, Product Design and Evaluation in 3rd Period, Occupational Safety and Health in 4th Period, and Human-Computer Interface in 5th Period. Moreover, the numbers of essay about Occupational Safety and Health, and Human-Computer Interface, Specific Workplace Related Research, Specific User Group Research, System Development and Evaluation, Driving Related Research, and Micro-ergonomics were increased period by period. However, the quantity of essays about Ergonomics Theory and Inspection Related Research were decreased. The results of this study will help to predict the future direction of Taiwan ergonomic research effort for the next 20 years.

**Keywords:** ergonomic, trend analysis, research papers, publication.

## 一、前言

人因工程(Human Factors/Ergonomics, HFE)發展已超過 60 年，最早是歐洲的英國 Institute of Ergonomics and Human Factors 於 1949 年成立、德國 Gesellschaft für Arbeitswissenschaft 1953 年成立，接著北美洲的美國 Human Factors and Ergonomics Society 成立於 1957 年、加拿大 Association of Canadian Ergonomists 成立於 1959 年，而亞洲的日本 Japan Ergonomics Society 成立於 1964 年、韓國 Ergonomics Society of Korea 成立於 1982 年，中國 Chinese Ergonomics Society 成立於 1989 年。現今全世界已超過 40 個國家及地區成立人因工程相關組織，專業人才漸增與研究議題多元，不論在廣度與深度發展上均相當可觀。

從論文發表的主題來分析 HFE 的發展，Waterson (2006)以 Ergonomics 期刊為研究對象，分析 1958~1999 年的論文主題，結果發現以 Human characteristics 為最多，當中生理面議題日漸增加，心理面的論文數逐漸減少；Performance-related factors 次之，該主題包含年齡、性別、個人差異、作業相關因素等議題，此兩項主題的論文總數超過 50%。Zavod (2000)分析了 1988-1997 年間 511 篇的 Human Factors Journal 論文，結果顯示 Visual performance 相關的論文數最多，共有 111 篇，佔全部論文 22%。Industrial ergonomics 與 Cognitive engineering 次之(10%)，Training 再次之(9%)。另外，Waterson (2012)探討 1961~2009 年間所舉辦的 16 場 IEA Congress 中所發表之 987 篇論文後發現，Ergonomic methods and methodology、Work on workload、Physiology 與 Product design 等主題的論文數逐年遞減，取而代之的是 Cognitive ergonomics、Human-computer interaction(HCI)、Organizational design and management 與 Work and health 等主題；另外有些主題的論文數量歷年來變化不大，如 Ageing、International standards 及 Education and training。Lee (2010)以 Journal of the Ergonomics Society of Korea 為對象，分析 1982~2009 年期間所發表的 649 篇論文，指出在 1982~1989 年間的研究主題以 Biomechanics anthropometry 最多(41%)，

Displays controls 及 workload analysis 同屬第二名，均為 12%。在 90 年代，Biomechanics anthropometry 與 Displays controls 仍是最多的主題，不過 Accidents safety 成為新的議題，占居第三名。2000~2009 年的論文數第一名仍是 Biomechanics anthropometry，第二名與第三名的主題則變成 Consumer products 與 Health medical。

中華民國的人因工程起始於 1984 年行政院國科會成立的「人因工程推動小組」，而中華民國 Ergonomics Society of Taiwan(EST)於 1993 年新竹國立清華大學正式成立，以此整合人因工程人力資源，共同合作提升人因工程學術研究及相關技術水準，並促進國際相關研究之交流。中華民國推動人因工程的知識、技術與理念，迄今已逾二十年的光陰，原本由國科會支持的研究推廣工作，陸續擴展到其他如勞委會、原委會、交通部等政府機構，民間產業在這方面的需求也日漸增多，更加突顯其重要性與發展潛力。而大專院校除了工業工程與設計相關系科之外，尚包含製造工程、車輛工程、工業安全衛生、物流管理、運動健康與休閒等系科，顯現不同領域之教學系所對於人因工程課程之重視與需求。探討我國人因工程研究主題發展的論文相當少，Hwang (1993)指出 Man-machine system 及 Industrial safety 是當時 EST 會員主要的研究領域。接著 Lee (2000)之研究亦顯示學術界認為 Occupational health、Man-machine system、Product design 三大領域是我國人因工程發展的重要項目，而業界則認為 Occupational health、Human performance、Human information processing 等三項主題較為重要。人因工程在中華民國發展二十年的今日，學術研究主題演變與趨勢之探討即為本研究目的，研究成果將作為規劃我國人因工程未來發展之重要參考。

## 二、研究方法

### (1)資料蒐集方式

本研究以 EST 永久會員為調查對象，由會員提供的學術論文著作目錄(至 2012 年 7 月底)來進行分析。至 2012 年 6 月底為止，EST 永久會員人數共計 201 人，而本研究取得其中 113 位會員的著作清單，資料含蓋率為 56%。

### (2)資料處理方法

本研究共蒐集了 1404 篇論文，最早的為 1971 年，最新的發表於 2012 年。接著將論文著作清單輸入至 Excel 2010 中，包含作者姓名、發表年代、篇名、期刊名、期數、卷數、頁碼、關鍵字等資訊。由於論文作者可能包含多位學者，為避免重複計算而高估整體論文發表數量，因此每篇論文只會被計算一次，而且學術論文只包含國內外期刊、學刊、學報之論文，不包含研討會論文集或研討會之後所出版的專輯之論文。另一方面，期刊名稱均統一修正為最新的刊名，以利後續分析。

### (3)論文主題分類

人因工程涉及的領域非常廣泛，除了包含基礎面的 Anthropometry、Psychology 外，應用面亦涵蓋 Consumer Products、Communication Systems 等，更高層次尚有 Work Design、Organizational design and management 等 macro-ergonomics 範疇。歷年來多篇研究區分人因工程研究主題，分類數量從 9 項到 25 項不等，端視研究樣本的屬性而定。本研究分類的項目共有 13 類，分別是 1.Ergonomic theory, 2.Ergonomic methodology, 3.Anthropometry, 4.Force exertion, 5.HCI, 6.System development, 7.Inspection task, 8.Product workplace evaluation, 9.Driving task, 10.Specific Industrial , 11.Specific user, 12.Occupational health, 13. Macro-ergonomics。每篇論文將只被分類至其中一項類別中。



#### (4)論文分析

本研究以 EST 成立的 1993 年為基準，1993 年以前視為第一時期，之後每五年為一時期，將論文發表的年代區分為五個時期，因此第一時期為 1971~1992 年、第二時期為 1993~1997 年、第三時期為 1998~2002 年、第四時期為 2003~2007 年、第五時期為 2007~2012 年。

### 三、研究結果

#### 1. 論文發表篇數與所屬期刊

每一時期論文發表總數如下圖 1，從第一時期的 72 篇逐期增加至第五時期的 475 篇，增加了 6 倍，每時期平均較前一時期成長 1.7 倍，可見我國人因工程的研究發表日益豐碩。進一步以發表的期刊來分析，1,404 篇論文分別發表在 342 種不同的期刊，篇數最多的前六名期刊依序是 JCIIE(95 篇，6.77%)、JOSH(92 篇，6.55%)、IJIE(87 篇，6.2%)、JES(78 篇，5.56%)、P&MS(68 篇，4.84%)、Applied Ergonomics(60 篇，4.27%)，合計占總篇數 34.19%，各期刊在各時期發表的篇數如圖 2。2002 年以前，JCIIE 是會員發表論文數最多的期刊，但在 2003~2012 年期間發表的數量逐漸遞減，取而代之的是 JOSH 與 JES，可能原因是早期人因工程歸屬於工業工程領域，而且我國並無人因工程專屬的期刊，因此學者多將研究成果發表在 JCIIE，直至 1993 年 JOSH、1999 年 JES 相繼創刊後，國內人因工程才擁有專屬的期刊，因此人因學者轉而將成果發表於此二種期刊上。IJIE 在 2002 年以前是 EST 會員發表論文數最多的國際期刊，2003 年以後則有 P&MS、Applied Ergonomics 兩本期刊急起直追。這種改變可能的原因是，早期我國以製造業為主，人因工程研究重點多在工作現場評估與改善，這與 IJIE 的主題較為貼近，因此學者多將研究成果發表於此期刊。而十年後產業轉向電子資訊業與消費性產品的設計與製造，吸引較多學者投注在產品評估與設計等相關研究上，因此論文轉而發表在 Perceptual and Motor Skills 與 Applied Ergonomics 兩本期刊中。

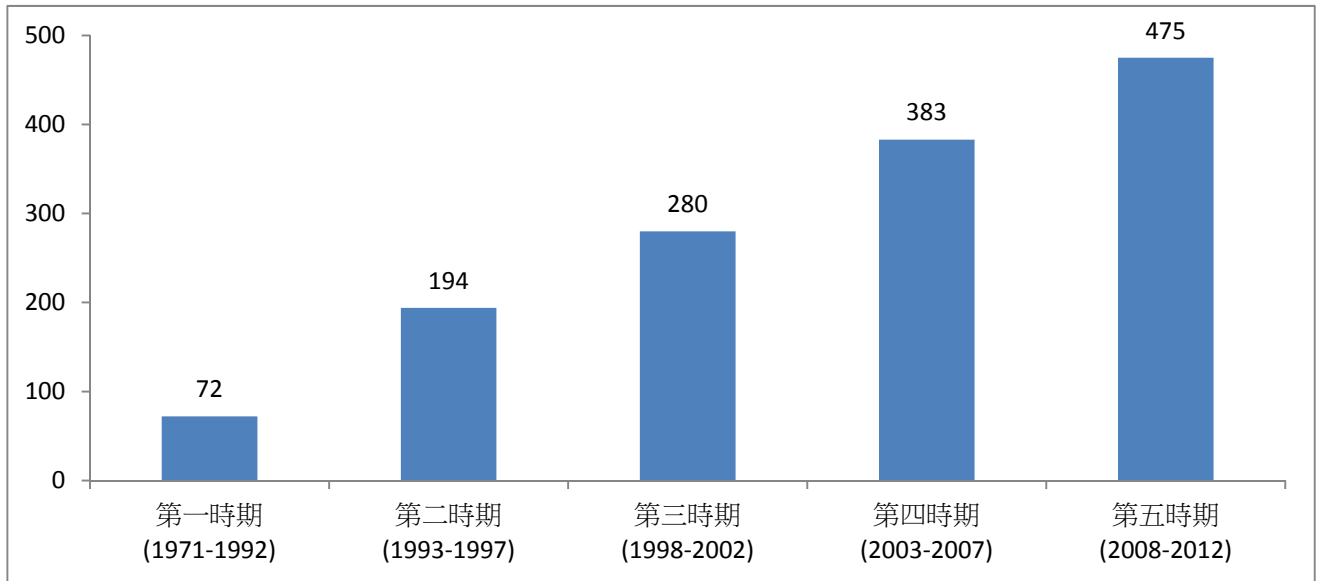


圖 1：每一時期論文發表的總數

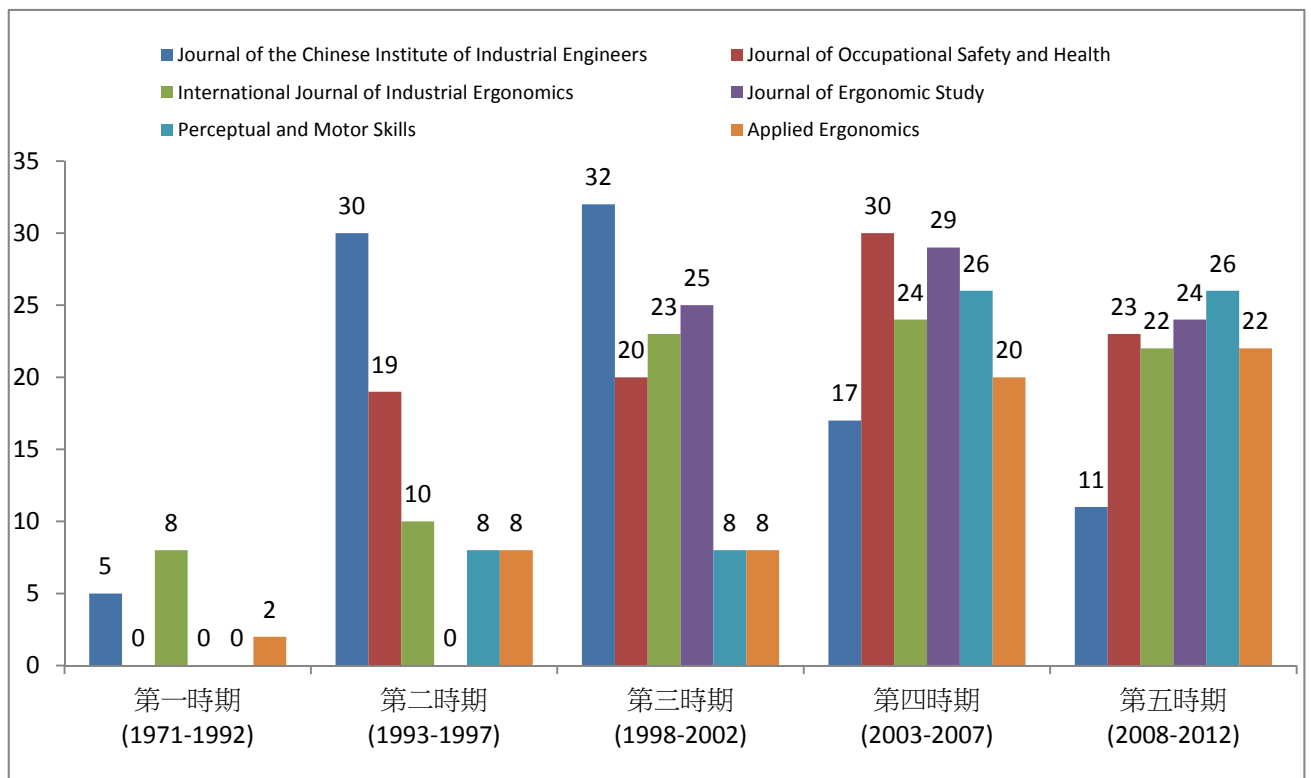


圖 2：論文發表總數前六名的期刊在各時期所發表的篇數情形

## 2. 論文研究主題

各人因主題的論文篇數如圖 3，篇數最多的是 Topic 8 (167, 11.89%)，該主題包含手工具(如刀具、螺絲起子、金工鋸、鑷子等)、標誌圖形符號(如量販店、醫院、機場等公共場所之標誌等)、桌椅(如課桌椅、工作椅等)、鞋具(如高跟鞋、鞋墊等)、3C 產品(如鍵盤、滑鼠、電子書、PDA、iPod、iPhone 等)、消費性產品(鍋鏟、牙刷、筷子、錢幣等)、場所或工作站(廚房、廁所)、腰背護帶等產品的評估、比較與設計。其次為 Topic 5(155 篇, 11.04%)，包含產品顯示器規格、產品輸入方式、顯示內容編排、使用環境的評估。第三項為 Topic 12(141 篇, 10.04%)，包含工作現場危害因子調查、肌肉骨骼或疾病之盛行率分析、跌倒、滑倒、墜落等研究。其他依序為 Topic 10(125 篇, 8.9%)、Topic 6(120 篇, 8.55%)及 Topic 4(115 篇, 8.19%)等。

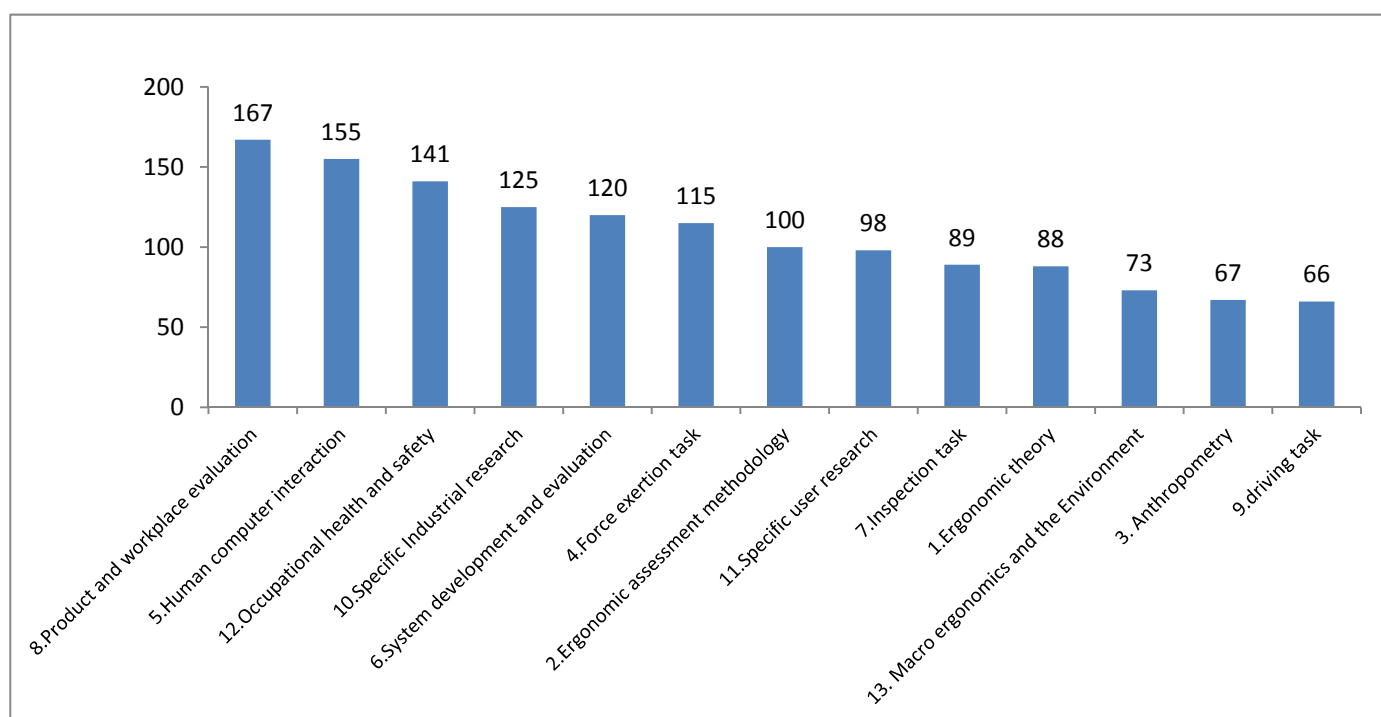


圖 3：各人因主題之論文數

進一步分析各時期的論文主題發表情形，結果如圖 4。第一時期發表的 72 篇論文中，以 Topic 2 與 Topic 8 篇數較多，共有 29 篇，占該時期論文數 40%。前者主題多著重在 EMG 之擷取與分析、motion analysis system 之評估與應用、biomechanical model 之建立等研究；後者主題多偏向 3C 產品(如中文電腦鍵盤、遙控器)之設計、手工具(如草耙、筷子、鍋鏟)之評估。第二時期的 194 篇論文以 Topic 4、Topic 7、Topic 1 與 Topic 2 等四項主題篇數較多，共有 101 篇，占該時期論文數 52%。Topic 4 論文多為探討抬舉作業與手部施力作業的各項工作條件對工作能力(如最大可接受抬舉重量、最大握力、扭力)或生理反應(如 EMG、HR)等影響。Topic 7 的研究偏重於建構機器視覺提升檢驗作業績效的方法論。Topic 1 則著重訊號偵測理論與人員認知能力相關的研究。Topic 2 包含肌力量測與其運作機制之探討、脊椎角度之量測法與活動度評估等主題。第三時期的 280 篇論文以 Topic 8、Topic 4、Topic 5 等三項主題篇數較多，共有 108 篇，占該時期論文數 39%。Topic 8 主要評量手工具(動力或手動螺動起子、職業用刀具、移液管)、課桌椅、腰背護帶等產品。Topic 4 延續上一時期的主題，聚焦在抬舉作業之工作能力、生理反應、生物力學等面向探討。Topic 5 在上一時期即有不少論文發表，在本時期的論文數更多，主要評估電腦螢幕所呈現的資訊對績效的影響，其中包含文字字型、色彩、亮度、對比或者 icon 尺寸、對比等項目對閱讀績效、辨識度、滑鼠點擊績效或視覺疲勞等研究。第四時期發表的 383 篇論文中，以 Topic 12、Topic 8、Topic 5 等三項主題篇數較多，共有 137 篇，占該時期論文數 36%。Topic 12 在前幾個時期均有一定的發表篇數，而在本時期達到高峰，其研究主要為工作現場的人因危害因子或意外事故原因之調查、勞工肌肉骨骼不適或職業病等盛行率調查分析、職場跌倒、滑倒或墜落事故之研究等項目。Topic 8 主要針對 3C 產品(隨身聽、電子書、觸碰筆、手機)與消費性產品(牙刷、筷子、遙控器)進行探討。Topic 5 除了繼續探討資訊內容呈現效果的影響外，同時有多篇論文探討螢幕種類、

尺寸、亮度等因子對閱讀距離、主觀偏好、視覺疲勞、閱讀績效的影響。第五時期發表的 475 篇論文中，以 Topic 5、Topic 12、Topic 10 等三項主題篇數較多，共有 189 篇，占該時期論文數 40%。Topic 5 仍有多篇論文持續探討資訊內容呈現效果的影響，另外研究的獨立變項日趨複雜化，同時探討顯示器硬體變項(極性、對比、解析度等)與環境變項(照度、光色)對使用者的影響。Topic 12 一方面為各種工作現場的人因危害、職業災害等因子進行調查與評估，另一方面也調查多種職業作業員的肌肉骨骼不適情形。Topic 10 在前幾個時期均有一定的發表篇數，而在本時期達到高峰，研究對象可區分為半導體或 TFT-LCD 廠、核電廠、醫護人員、營造業、軍事等五大類，分別針對現場風險因子、肌肉骨骼不適情形、設施系統等人機介面、工作現場所使用的器具等項目進行評估與改善。

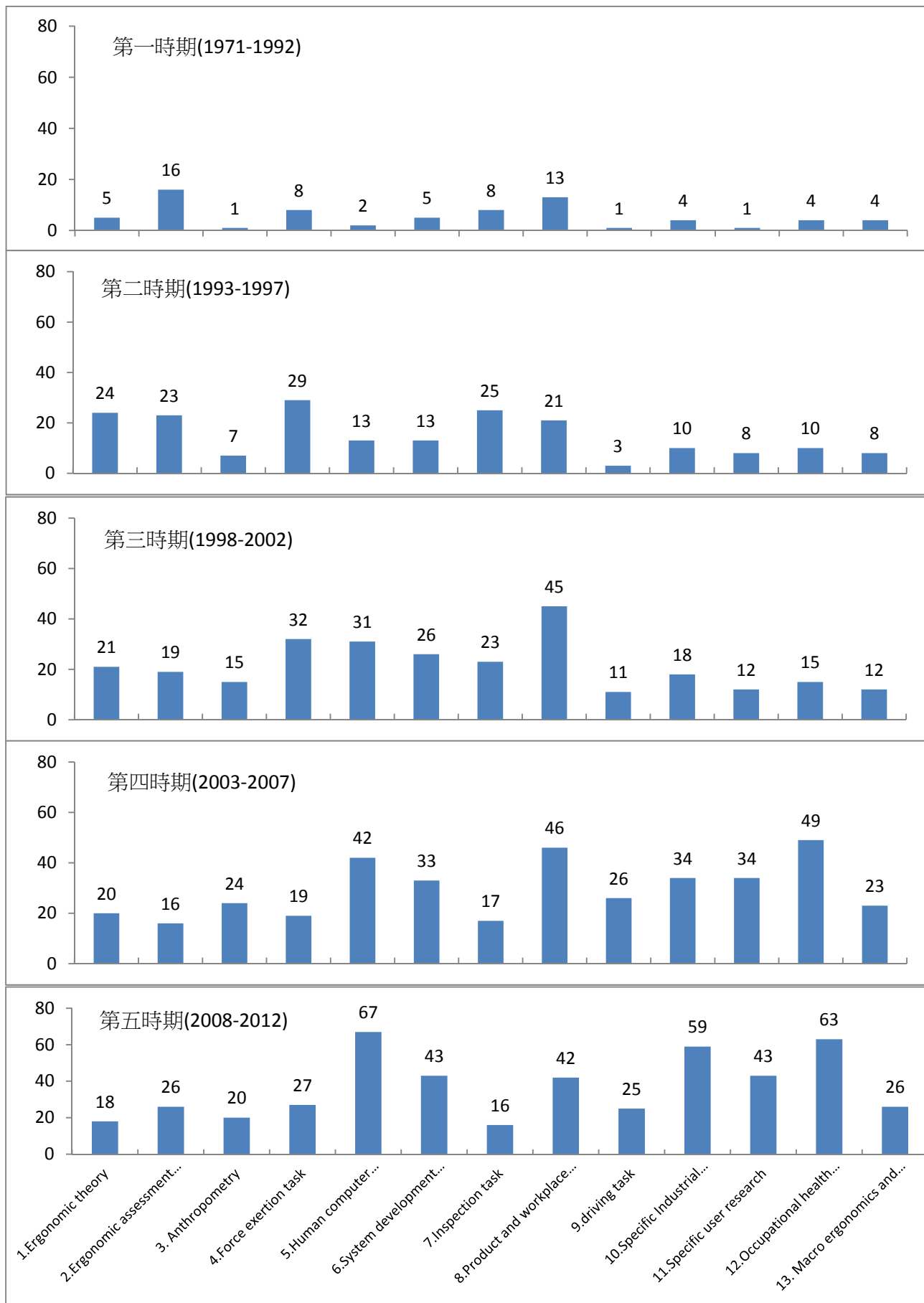


圖 4：各論文主題在各時期之發表情形

### 3. 人因研究主題之變化趨勢

現以第一時期為基準，分別計算第二至第五時期各主題篇數之增減情形，結果如圖 5。圖中可發現論文篇數呈現正成長的主題有 Topic 5、Topic 12、Topic 10、Topic 11、Topic 6、Topic 9、Topic 13 等七項，其中又以 Topic 5 的論文數增加最多，第五時期的論文數比第一時期多了 65 篇，其次為 Topic 12，比第一時期多了 59 篇，第三為 Topic 10 增加了 55 篇。

進一步分析 Topic 5 的研究內容，發現研究對象從職場所使用的 VDT 工作站轉變為一般民眾使用的各式電子資訊產品(如電子書、電子紙、手機等)，評估項目從滑鼠鍵盤操作績效、文字辨識度轉變為閱讀理解性、偏好姿勢、主觀喜好度等，不過探討的重心多數圍繞在資訊內容呈現效果(文字或者電腦圖示的尺寸、色彩、亮度、與背景對比等)的影響。Topic 12 的研究不管在哪一時期均同時兼顧工作現場與基礎研究兩種重點，一方面在實驗室評估各種人因危害因子(鞋底摩擦力、跌倒、震動等)的影響進而建立學理模式與檢核表，另一方面以人因方法評估各種工作現場(鋼鐵廠、餐飲業、飯店業等)的危害因子並進行改善。Topic 10 早期以醫護人員為研究對象，近年來則以半導體或 TFT-LCD 廠等高科技產業以及核電廠控制室等為主，半導體或 TFT-LCD 廠的研究內容包含無塵室作業員的肌肉骨骼不適、晶圓搬運作業之評估、無塵鞋(衣)之評估、輪班作業之影響、造成工作壓力之原因等；核電廠研究多著重在控制室之人機介面、緊急系統、緊急操作程序與人員可靠度等。

Topic 1 與 Topic 7 此二項主題的論文篇數呈現負成長，從研究內容得知第二時期有較多的研究用於建構人因工程相關的理論基礎(如訊號偵測理論、決策過程、閾值、人員績效與可靠度等)，以及較多的學者運用 Fuzzy、Neural Network、Genetic Algorithm 等數學模式提升自動辨識系統的績效，但後來研究主題轉移到 HCI 與職業安全與衛生領域，使得論文篇數逐年遞減。

而 Topic 8、Topic 3、Topic 4、Topic 2 等四項主題的論文發表情形較為波動，其中 Topic 8 與 Topic 3 在第三時期、第四時期的論文數為呈現增加的趨勢，但在第五時期則略為減少。Topic 4 與 Topic 2 則相反，在前幾個時期的論文數逐漸減少，但在第五時期的論文數又再增加。

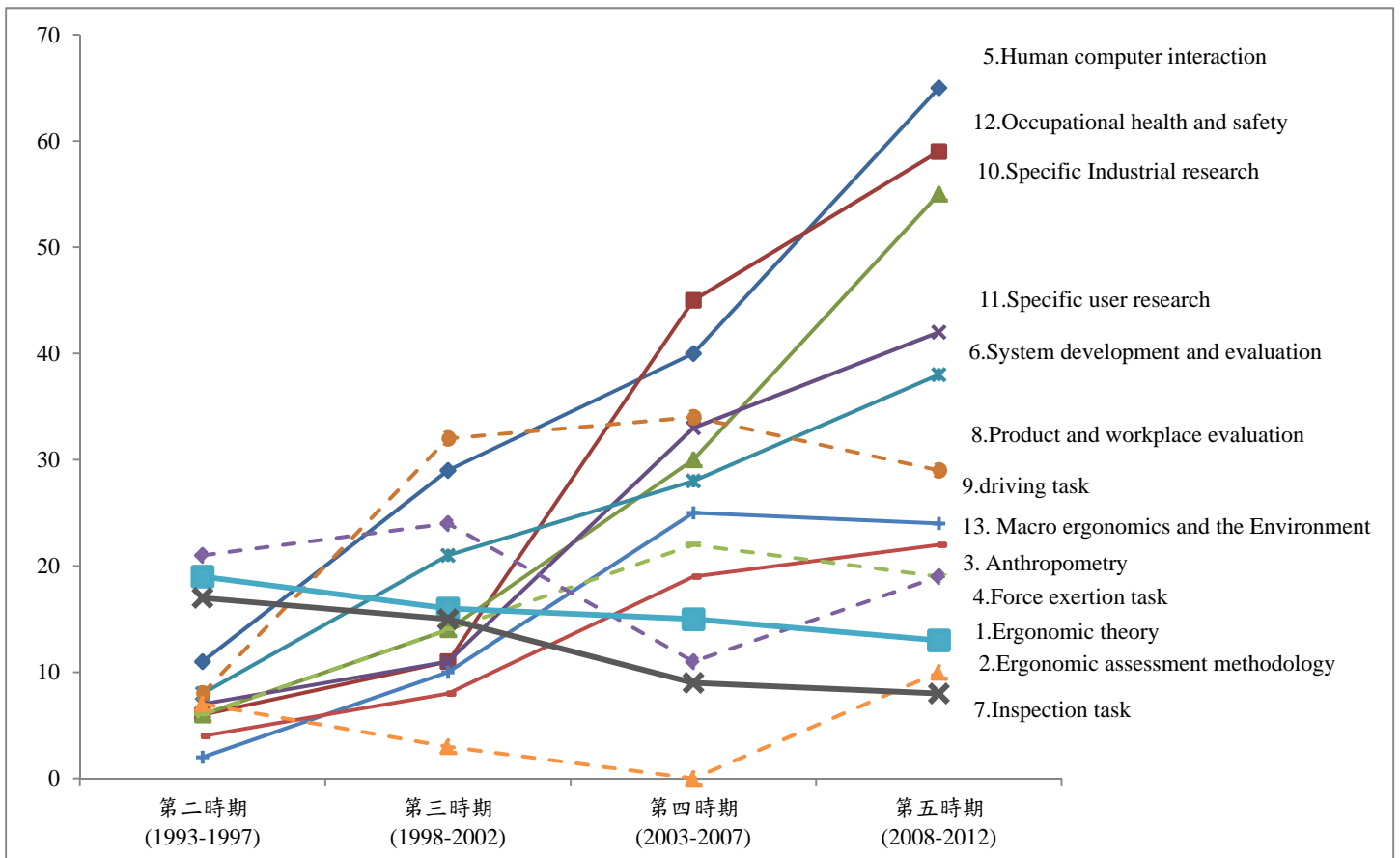


圖 5：以第一時期為基準，第二~第五時期中人因主題論文數之增減情形



## 四、討論

### 1. 國內人因研究主題之變化

在 1993~1997 時期，Topic 3 的論文數增加最多，此時期正值勞工安全衛生研究所與國科會投注大量經費，針對我國勞工進行大規模的人體計測資料蒐集與資料庫之建立，因此有較多人體計測相關的研究產生。另外本時期 Topic 7 的論文數也增加不少，這可能與早期我國人因工程學者多具有數理、機械背景有關，工業工程除了從生產管理面或品質管理面改善工廠運作績效外，人因工程學者從檢驗作業找到可發揮之處，結合數學模式與機械知識提升機器視覺的檢驗績效。2000 年之後，由於政府持續推展「兩兆雙星」產業，因此半導體與 TFT-LCD 產業也有豐富的人因論文發表。

Hwang (1993)運用問卷調查的方式詢問 EST 會員主要的研究領域，結果與 Lee (2000)調查學術界人士的成果相似，受訪者均指出 Occupational health 及 HCI 是最主要的研究領域，本研究從論文發表的主題中同樣發現此一現象。1997 年以前的論文主題大多屬於人因理論建構與量測方法建立等基礎研究，或產品檢驗、抬舉作業或手部施力等作業評估上，而 1998 年後，HCI 的論文數一直在前三名之中，Occupational health 論文數則在 2003 年後進入前三名，直至第五十時期，Occupational health 及 HCI 的論文數分占第一、二名。由此可知，國內學者在 Occupational health 及 HCI 領域的持續努力，多年後終於在期刊論文上看到研究成果。

### 2. 國外人因研究主題之比較

由於探討論文發表主題之文獻中，各學者所分析的年代、定義的主題與主題數量都不盡相同，因此無法直接進行比較，只能以相近主題或發展趨勢進行說明。根據 Waterson (2012)的研究指出，IEA 的論文在 1990 年以前一直以 Ergonomic methods 相關內容為主，這以國內 1992 年以前發表論文數最多的主

題相同。1994 以後，IEA 論文以 HCI 與 Work and health 主題的論文數增加最快。另外 Ergonomics 期刊在 1990~1999 年間的研究主題同樣以 Health and safety 增加最多(Waterson & Sell, 2006)，同一時期 Human Factors Journal 以 Visual performance 的論文數最多(Zavod & Hitt, 2000)；Occupational health and safety 也是德國人因研究主要的議題(Zink, 2000)；Displays and controls 亦成為韓國新的熱門議題(Lee, 2010)，而國內同樣以 Occupational health、HCI 的論文數增加最多，可見此一時期一方面由於電腦設備大量被應用在工廠與生活中，國際間掀起一股人機介面的研究熱潮；再方面因為 70 與 80 年代對工廠安全的持續研究，在 90 年代開花結果，因此有較多安全與衛生方面主題的論文發表。不過同時在 90 年代，Cognitive ergonomics 與 Organizational design and management 的研究論文數也不在數，但國內在此兩項主題發表的論文數相對較少(Cognitive ergonomics 包含在本研究所定義之 Topic 1、Organizational design and management 包含在 Topic 13)。

在 2000 年之後，除了 HCI 論文仍持續增加外，IEA 有不少論文將 Work and health 延伸至 Healthcare 主題上，而韓國 Health and medical systems 論文數排名躍上第三名，僅次於 Biomechanics anthropometry 與 Consumer products 主題。而 Consumer products and tools 之研究之能夠成為該國熱門主題，與政府投注大量經費，推廣資訊與通訊科技相關研究有密切相關(Lee, 2010)。由此可發現，政府經費的投入有助於學者進行相關的研究，之後將會有論文發表的成果，就如同本國在 2000 年之後，除了 Occupational health and safety 與 HCI 的論文數持續成長外，由於政府支持「兩兆雙星」產業，進而使的 Topic 10 中的半導體與 TFT-LCD 產業的論文數顯著成長。

對於未來人因工程的發展方向，Lee (2010)提出韓國將會以 Sensibility engineering、Aviation safety 與 Aging 等三項議題為主要發展方向。除了特定發展項目外，Zink (2000)建議未來人因工程應從 Micro-ergonomics(主要為工程

技術上的研究與應用)拓展到 Macro-ergonomics(主要為組織面、管理面與策略面)，才能擴大人因工程的影響，更要將研究結果從理論面落實至實務面，不只強調「工作狀態」的改善，同時也要凸顯「工作流程」改進後的經濟效益。而 Waterson (2012)也同樣指出，Organizational design and management 的議題將會持續發燒。Drury (2008)指出由於科技的改變，經濟型態已經從農業、製造業轉變為服務業，越來越多人從事的是「服務性的操作」—提供眾多的選項以及協助消費者做決定，因此人因工程的研究除了在體力作業相關議題上外，另外應著重 Decision making 相關的議題。而且全球化的影響，工作的地點與所需的技能差異將日益擴大，再加上勞動人口的多樣化(如工作年限延長、婦女以及身心障礙者的參與)，工作將越難找到合適的從事者來勝任，而這就是人因工程持續要努力的目標—將工作需求與從事者能力完美配合。

## 五、結論

EST 於 2013 年屆滿成立 20 周年，相較於其他各國雖然起步較晚，但這些年來在產官學研各界人士持續努力下，不管在職業衛生與安全、工廠效能提升、學術論文發表各方面均有顯著的貢獻。本研究透過分析 EST 永久會員所發表的期刊論文後發現，論文發表總數前六名的期刊分別為 JCIIE、JOSH、IJIE、JES、P&MS 及 Applied Ergonomics。過去二十年來，國內人因工程論文每五年均以增加 100 篇的速度在成長，主題從早期著重人因工程評估方法等基礎研究，後來偏重於職業安全與衛生，以及近年的 HCI 主題，均與國際熱門議題有高度關聯性。未來，因應時代的趨勢，本國人因工程建議可多著力於認知人因工程(縮短服務業從業人員能力與工作需求之間的差距)、組織人因工程(協助企業得以快速調整組織來因應市場需求)以及保健(人口老化的影響)等相關議題上，以期人因工程在本國與國際間持續發光發熱。

## 參考文獻

- Hwang, S. L., Shih, Y.-C., Cheng, C. H., Lin, C. S., Woon, C. H., Son, H. H., & Cheng, C. J. (1993). The Investigation of Current Researches for Human Factors and Ergonomics. *Journal of Occupational. Safety and Health, 1*(2), 19-27.
- Lee, D. H. (2010). A study on trend of the research papers published in the Journal of the Ergonomics Society of Korea. *Journal of the Ergonomics Society of Korea, 29*(4), 701-707.
- Lee, K. S. (2000). Vision of Asian Ergonomics: The Trend of Ergonomics Development in Korea. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 44*(38), 692-695. doi: 10.1177/154193120004403802
- Lee, T. Z., & Wang, J. J. (2000). Ergonomics in Taiwan: The present and future. *Journal of Ergonomics study, 2*(1), 1-10.
- Waterson, P., Falzon, P., & Barcellini, F. (2012). The recent history of the IEA: an analysis of IEA Congress presentations since 1961. *Work: A Journal of Prevention, Assessment and Rehabilitation, 41*, 5033-5036.
- Waterson, P., & Sell, R. (2006). Recurrent themes and developments in the history of the Ergonomics Society. *Ergonomics, 49*(8), 743-799.
- Zavod, M., & Hitt, J. M. (2000). Summary of the publishing trends of the Journal of Human Factors from 1988-1997. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 44*(33), 6-108-106-111.

# 國科會補助專題研究計畫項下出席國際學術會議心得報告

103 年 04 月 11 日

計畫編號	NSC 102-2221-E-144 -001		
計畫名稱	我國人因工程二十年之論文發表主題調查與分析		
出國人員姓名	林志隆	服務機構及職稱	國立臺灣藝術大學工藝設計學系 助理教授
會議時間	103 年 04 月 03 日至 103 年 04 月 06 日	會議地點	Rihga Royal Hotel Osaka, Japan
會議名稱	(中文) 第五屆亞洲藝術與人文會議 (英文) ACAH 2014 -- The Asian Conference on Arts and Humanities		
發表論文題目	(中文) 臺灣過去 20 年人因趨勢研究 (英文) A Study on Trend of the Ergonomic Research Papers over the Past 20 Years in Taiwan		
<p>一、參加會議經過</p> <p>此次會議為 ACAH 2014，於 4 月 3 日至 6 日在日本大阪的 Rihga Royal Hotel 舉行。該會議共吸引來自 40 多國 600 多人參與，當中共有篇 330 論文，其共分屬 27 個領域：</p> <ol style="list-style-type: none"> <li>1. Teaching and Learning the Arts</li> <li>2. Arts Policy, Management and Advocacy</li> <li>3. Arts Theory and Criticism</li> <li>4. Social, Political and Community Agendas in the Arts</li> <li>5. Visual Arts Practices</li> <li>6. Performing Arts Practices: Theater, Dance, Music</li> <li>7. Literary Arts Practices</li> <li>8. Media Arts Practices: Television, Multimedia, Digital, Online and Other New Media</li> <li>9. Other Arts</li> <li>10. Media, Film Studies, Theatre, Communication</li> <li>11. Aesthetics, Design</li> <li>12. Language, Linguistics</li> <li>13. Knowledge</li> <li>14. Philosophy, Ethics, Consciousness</li> </ol>			

15. History, Historiography
16. Literature/Literary Studies
17. Political Science, Politics
18. Teaching and Learning
19. Globalisation
20. Ethnicity, Difference, Identity
21. Immigration, Refugees, Race, Nation
22. First Nations and Indigenous Peoples
23. Sexuality, Gender, Families
24. Religion, Spirituality
25. Cyberspace, Technology
26. Science, Environment and the Humanities
27. Other Humanities

在為期 4 天的議程中，開幕演講主辦單位邀請名古屋大學 Minoru Karasawa 教授，演講關於社會認知的廣義研究。透過探索認知的過程，了解人類為何都做過將訊息過於簡化或誇大，或是經由實證調查，揭示不同類型的群際衝突的認知和情感成分等。當中關於集體共享的認知研究方面，藉由研究人們如何傳輸分類和推理的信息，如刻板印象與交際語境的因果判斷。學習語言，在我們的認知中的作用也意味著文化作為一個主要的基礎和語言活動的組成部分的研究。語言，文化和認知之間的相互影響是一個非常重要的研究課題。透過上述研究，可逐漸幫助我們了解影響社會信息加工動機和社會因素。

另外本人本次發表的 2 篇論文分別發表於 4 月 6 日上午與下午。第一篇 “The Study of Match Degree Evaluation between Poetry and Paint” 與會學者有來自斯里蘭卡、香港、埃及與臺灣，並對於影響受試者的認知感受是以畫作，還是詩詞為先特別感興趣，其中一位學者提出畫家是否有決定畫作名稱的權利，與在場者進行討論。另一篇 "A Study on Trend of the Ergonomic Research Papers over the Past 20 Years in Taiwan " 參與學者對於臺灣能在這麼短時間就能產出質量均優的人因工程相關研究成果表示肯定。整體而言與會學者所提出的問題都非常有建設性，得以充實個人往後研究內容非常有幫助。



圖 1 Rihga Royal Hotel



圖 2 報到場地



圖 3 報到

## 二、與會心得

首先感謝國科會的補助讓申請人有機會參與 ACAH2014 國際學術研討會。該會議的經常性組織 IAFOR 的學者來自歐美日等世界各大學，並在全球舉辦關於人文、社會及科技等相關學術研討會，此次在大阪舉行的會議以" Individual, Community & Society: Conflict, Resolution & Synergy" 為主題，探討人類生存的特徵長是以衝突的形式來呈現，像是每個人藉由自我與社會之間的鬥爭來顯現自身與他人的不同，另一方面我們在社區與社會相互依存的結構也一直受到挑戰，因此透過多元觀點的辯證，儘管它可能會導致衝突，但可以讓思想在社區和社會起到重要的作用。整體而言本次會議含括的議題相當廣泛，經由各方學者提出不同的思維觀點進交流，呈現藝術和人文科學多元的研究探索與解釋，得以激發創新性的概念。除此之外，本人除了參與自己論文發表的場次外，更充分利用時間聆聽其他領域的研究主題並進行交流，以此拓展研究觀點。



圖 4 發表的論文之一



圖 4 發表的論文之二



圖 6 主持論文發表



圖 7 研究交流(1)



圖 8 研究交流(2)



圖 9 聆聽他場報告

## 三、考察參觀活動

無。

## 四、建議

出國參加國際研討會並非只是磨練英語，藉由來自各國學者與研究員研究成果的交流，可互相吸取經驗與觀點，進而提升參與者的研究眼界與水平。然而國際研討會相關支出亦是一筆可觀的開銷，除了感謝國科會的補助使申請人能有機會參與這次國際盛會，同時也希望國科會能持續給予鼓勵與協助，讓本人有更多機會於國際研究舞台上與各國學者交流，拓展臺灣學術研究的國際觀。

## 五、攜回資料名稱及內容

ACAH 2014 國際學術研討會的書面資料，其中包括大會詳細議程。

## 六、其他

附上參加本次研討會所發表的論文全文。



# acah2014

## The Fifth Asian Conference on the Arts and Humanities

April 3-6, 2014

Organized by the International Academic Forum in affiliation with conference partners Waseda University (Japan), Birkbeck, University of London (UK), University of Lincoln (UK), Virginia Tech (USA), The National Institute of Education (Singapore), Tainan University (Taiwan), and the Hong Kong Institute of Education (HKSAR).

Held at The Rihga Royal Hotel & The Osaka International Conference Center

### Certificate of Oral Presentation

Chih-Long Lin  
(National Taiwan University of Arts, Taiwan)

has presented the paper entitled:

*A Study on Trend of the Ergonomic Research Papers over the Past 20 Years in Taiwan*

This is to confirm that Chih-Long Lin (0425), having presented the above paper, actively participated in The Fifth Asian Conference on the Arts and Humanities, and thereby contributed to the academic success of the event.

Please contact me for any further details.



Dr. Joseph Haldane  
Executive Director  
The International Academic Forum





2014

acaah  
librasia





Sunday Session IV: 15:00 -16:30

Sunday Session IV: 15:00 -16:30

Room: 702 (OICC 7F)

ACAH – History: Historiography

**Session Chair: Chih-Long Lin**

0400 - 15:00 – 15:30

*The Old and New Malaya of the Colonial Days and It's Continuity in the Modern Day Malaysia*  
Sivachandralingam Sundara Raja, University of Malaya, Malaysia

0425 - 15:30 – 16:00

***A Study on Trend of the Ergonomic Research Papers over the Past 20 Years in Taiwan***

Chih-Long Lin, National Taiwan University of Arts, Taiwan

Si-Jing Chen, National Taiwan University of Arts, Taiwan

Sunday Session IV: 15:00 -16:30

Room: Ohgi (Rihga 6F)

ACAH – Humanities: Media, Film Studies, Theater & Communication

Session Chair: Alfonso J. Garcia Osuna

0041 - 15:00 – 15:30

*The Influence of Tolerance for Disagreement (TFD) on the Decision-Making Process of Student Organizations*  
Carson Jeffrey Cruz, University of the Philippines Los Baños, Philippines

0049 - 15:30 – 16:00

*The Dynamics of Social Interdictions: Exclusion and its Cultural Agencies in Twentieth Century Cuba*  
Alfonso J. Garcia Osuna, The City University of New York, USA

Sunday Session IV: 15:00 -16:30

Room: Takara (Rihga 6F)

ACAH – Humanities: Teaching, Learning & Education

Session Chair: Bruce Gatenby

0105 - 15:00 – 15:30

*Curriculum without Boundaries: Developing an Ecological Connection of Higher Education Curriculum*  
Chia-Ling Wang, National Taiwan Ocean University, Taiwan

0054 - 15:30 – 16:00

*No One Cares about Your Story: Personal Experience, Therapeutic Alienation, and the Community of Learners in Teaching Academic Writing*

Bruce Gatenby, American University of Sharjah, UAE



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Submission topic- Humanities: History, Historiography

A study on trend of the Ergonomic research papers over the past 20 years in Taiwan

Chih-Long Lin and Si-Jing Chen

National Taiwan University of Arts

#### Author Note

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# A study on trend of the Ergonomic research papers over the past 20 years in Taiwan

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<sup>2</sup> Graduate School of Creative Industry Design, National Taiwan University of Arts

## Abstract

The Ergonomics Society of Taiwan will celebrate its 20th anniversary in 2013. The study looked into the development of Ergonomics in Taiwan by analyzing 1,404 papers published by 113 lifetime members of the Ergonomics Society of Taiwan. The authors examined each essay by key words and context of abstracts and coded along period of publication (1971-1992(1st Period), 1993-1997(2nd Period), 1998-2002(3rd Period), 2003-2007(4th Period), and 2008-2012(5th Period)), and 13 topic categories. The results show that the publication has an increase of about 100 essays every five years since 1993. The most popular topic was Ergonomic Assessment and Analysis Techniques in 1st Period, Force Exertion Related Research in 2nd Period, Product Design and Evaluation in 3rd Period, Occupational Safety and Health in 4th Period, and Human-Computer Interface in 5th Period. Moreover, the numbers of essay about Occupational Safety and Health, and Human-Computer Interface, Specific Workplace Related Research, Specific User Group Research, System Development and Evaluation, Driving Related Research, and Micro-ergonomics were increased period by period. However, the quantity of essays about Ergonomics Theory and Inspection Related Research were decreased. The results of this study will help to predict the future direction of Taiwan ergonomic research effort for the next 20 years.

*Keywords:* ergonomic, trend analysis, research papers, publication.

The development of Human Factors/Ergonomics (HFE) has spanned over more than 60 years, starting in Europe from the establishment of the Institute of Ergonomics and Human Factors in England in 1949 and the establishment of Gesellschaft für Arbeitswissenschaft in Germany in 1953, followed in the North America by the founding of Human Factors and Ergonomics Society in USA in 1957 and the Association of Canadian Ergonomists in 1959. In the Asia region, Japan Ergonomics Society was founded in 1964, the Ergonomics Society of Korea was founded in 1982 and the Chinese Ergonomics Society was founded in 1989. Nowadays, HFE-related organizations have been established in over 40 countries and regions in the world.

Zavod and Hitt (2000) analyzed 511 essays in the Human Factors Journal published between 1988 and 1997. The results showed that theses related to visual performance were the majority with 111 essays accounting for 22% of the total published; followed by industrial ergonomics and cognitive engineering (10%) and training (9%). Furthermore, Waterson, Falzon, and Barcellini (2012) investigated the 987 essays published in 16 International Ergonomics Association Meetings and Congresses events convened during the period from 1961 to 2009 and discovered that essay topics based on ergonomic methods and methodology, work on workload, physiology, and product design declined over the years with topics on cognitive ergonomics, human-computer interaction (HCI), organizational design and management, and work and health gradually taking dominance. Meanwhile, thesis based on some topics such as aging, international standards, and education and training remained stable during the same period. Lee (2010) employed the Journal of the Ergonomics Society of Korea as the subject of research in which 649 essays published from 1982 to 2009 were analyzed. The results indicated that in the period between 1982 and 1989, research topics based on biomechanics, anthropometry and work physiology were the majority (41%) with both the topic of displays and controls and the topic of work system and workload analysis taking second place (12%).

The development of HFE in the R.O.C. was initiated by the “Ergonomics Steering Group” established by the National Science Council (NSC), Executive Yuan in 1984 and the Ergonomics Society of Taiwan (EST) was officially founded in 1993 by the National Tsing Hua University at Hsinchu to integrate human resources in HFE. The R.O.C. has been promoting the knowledge, technicalities and concepts of HFE for over 20 years. The research and implementation efforts originated from the

support of the NSC are now gradually extending to other government institutions such as the Council of Labor Affairs, Atomic Energy Council and the Ministry of Transportation and Communications. Together with the rising demand for ergonomics in the private sector, the importance and potential of ergonomics are increasingly evident. In addition to the departments related to industrial engineering and design, tertiary education also includes departments of manufacturing engineering, vehicle engineering, industrial health and safety, logistics management, and health and leisure sports, attesting the emphasis and demand on courses in ergonomics in the various fields of academic faculties. Essays investigating the development of HFE research topics in Taiwan are rare. Hwang et al. (1993) indicated that the man-machine system and industrial safety were the major domains of study by the EST members at the time. This was supported in the research by Lee and Wang (2000) showing that the academia recognized occupational health, man-machine system and product design as the three major domains vital to the development of HFE in Taiwan, while the industry identified topics on occupational health, human performance and human information processing were more important.

Now with 20 years of history in the development of HFE in the R.O.C., this study intends to investigate the evolution and trend in academic research topics. The findings from this research will be considered as important references in planning the future development of HFE in Taiwan.

## **Method**

### **Method of data collection**

This study employed the permanent members of the EST as the subject of research and analyzed the table of contents of academic essay writings (till the end of July, 2012) provided by the members. The total number of permanent members of the EST was 201 by the end of June, 2012. This research obtained the list of works by 113 members with a data coverage rate of 56%.

### **Method of data processing**

This study collected a total of 1,404 essays ranging from the earliest publication in 1971 to the latest in 2012. The list of essay writings was keyed into Excel 2010 with entries containing information such as author, year of publication,

title of the thesis, title of the periodical, volume, issue, page number and keywords. In the possible case that several authors were included in the thesis, each essay was counted only once to avoid repeated counting and the overestimation of the publications as a consequence. Academic studies only included essays in domestic and international periodicals and journals; those published in the proceedings of conferences or as a collection of paper for conferences were excluded. Additionally, all periodicals were updated with the latest titles to facilitate subsequent analysis.

### **Categorization of essay topics**

HFE is involved in a wide variety of fields. On top of the fundamental anthropometry, psychology, work physiology, test and evaluation, it also covers applications such as consumer products, communication systems, automation and expert systems, transport systems, health and medical systems and higher level macro-ergonomics such as work design, organizational design and management, training and education within its scope. Over the years, many studies differentiated HFE research topics into 9 to 25 categories depending on the characteristics of the research samples (Hwang et al., 1993; Lee, 2010; Lee, 2000; Lee & Wang, 2000; Waterson et al., 2012; Waterson & Sell, 2006; Zavod & Hitt, 2000). This study examined a total of 13 categories classified as

1. Ergonomic Theory,
2. Ergonomic Assessment Methodology,
3. Anthropometry,
4. Force Exertion Task,
5. HCI,
6. System Development and Evaluation,
7. Inspection Task,
8. Product and Workplace Evaluation,
9. Driving Task,
10. Specific Industrial Research,
11. Specific User Research,
12. Occupational Health and Safety,
13. Macro-Ergonomics and the Environment.

Each essay was classified into only one of the 13 categories.



## **Analysis of the essay**

This study used 1993, the year when the EST was established, as a baseline to segment the years before 1993 as the 1st period and every subsequent five-year interval as a separate period. The years of essay publications were segmented into five periods: the 1st Period is from 1971 to 1992, the 2nd Period is from 1993 to 1997, the 3rd Period is from 1998 to 2002, the 4th Period is from 2003 to 2007 and the 5th period is from 2007 to 2012.

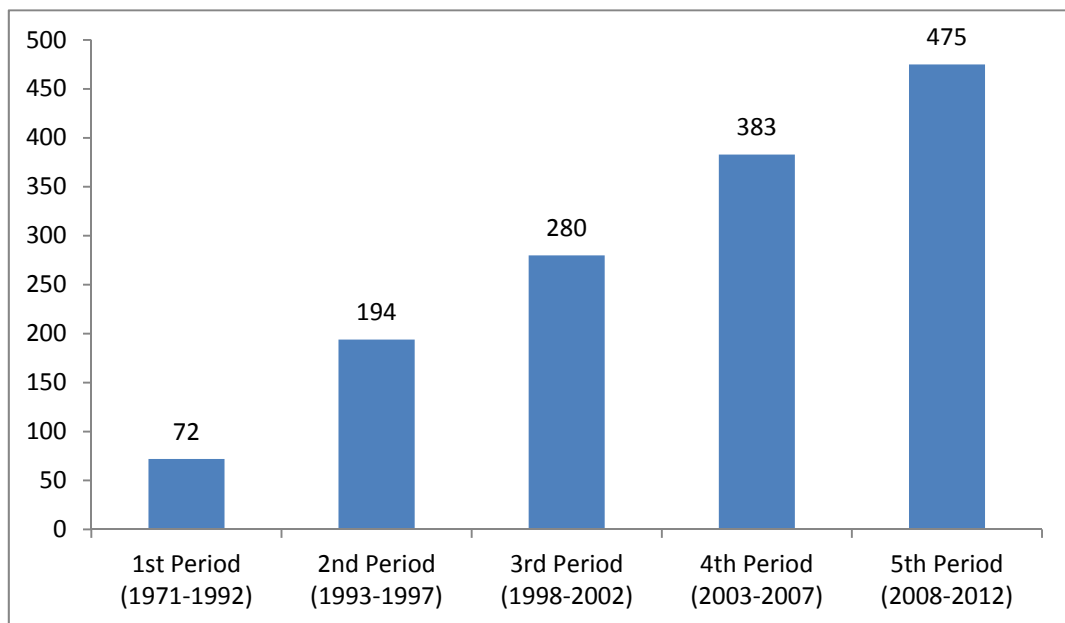
## **Results and Discussion**

### **The quantity of essays published and the publishing periodicals**

Examining the total number of essays published during each period as illustrated in Figure 1, the 72 essays in the 1st period continuously increased by the year to 475 essays in the 5th period, which is a 6-fold increase with an average growth of 1.7 times than the previous period. This indicates a gradual proliferation of HFE research publications in Taiwan.

In-depth analysis of the publishing periodicals shows that 1,404 essays were published in 342 types of different journals. The top six periodicals ranked by the quantity of essays in descending order are Journal of the Chinese Institute of Industrial Engineers(JCIIE) (95 essays, 6.77%), Journal of Occupational Safety and Health(JOSH) (92 essays, 6.55%), International Journal of Industrial Ergonomics(IJIE) (87 essays, 6.2%), Journal of Ergonomic Study(JES)(78 essays, 5.56%), Perceptual and Motor Skills(P&MS) (68 essays, 4.84%) and Applied Ergonomics (60 essays, 4.27%), which combine to account for 34.19% of the total published. The quantity of essays published in each of the periodicals during each period is illustrated in Figure 2. Prior to 2002, JCIIE published most of the essays by the members; however the quantity of its publication declined in the period from 2003 to 2012, which was replaced by JOSH and JES. A possible explanation is that HFE was classified as a field in industrial engineering in the early days so scholars published most of their research work on JCIIE with the absence of periodicals dedicated to HFE in Taiwan. It was not until the first publications of JOSH in 1993 and JES in 1999 that HFE finally had its dedicated periodicals in Taiwan. Therefore, HFE scholars shifted their publications to these journals. The

EST members published most of their essays in the international journal IJIE prior to 2002. After 2003, P&MS and Applied Ergonomics had been growing rapidly. A reason for this change is that manufacturing was the primary industry in Taiwan. As a result, most of the HFE researches concentrated on workplace evaluation and improvement, which prompted the scholars to publish their researches on IJIE as it was more associated with the topics of the journal. The primary industry has then been shifting towards the design and manufacturing of digital information and consumer products in the past 10 years, thus attracting more scholars to focus on researches related to product evaluation and design. Therefore, the essay publications were also shifted to the journals Perceptual and Motor Skills and Applied Ergonomics.



*Figure 1.* The total number of essays published during each period.

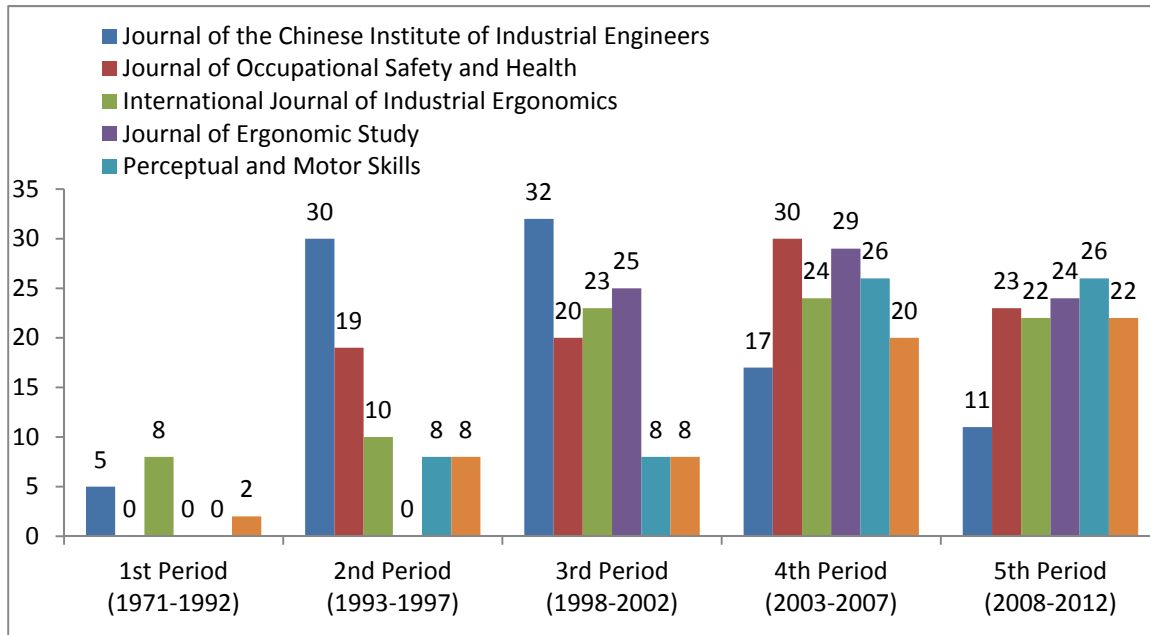


Figure 2. The quantity of essays published in the top six periodicals during each period.

### Research topics of the essays

The quantity of essays published in each category of topics is illustrated in Figure 3. The result shows that Topic 8 (167 essays, 11.89%) contains the most essays including hand tools (such as knives, screwdrivers, metalworking saws and tweezers); signage diagrams and symbols (such as signage used in discount stores, hospitals, airports and other public spaces); furniture (such as desks, chairs and work chairs); footwear (such as high-heels and insoles); 3C products (such as keyboard, mouse, electronic books, PDA, iPod and iPhone); consumer products (such as spatula, toothbrush, chopsticks and coins); spaces or work stations (such as kitchen and toilet); and the evaluation, comparison and design of lumbar and back support products. The second ranked by the quantity of essays is Topic 5 (155 essays, 11.04%), which includes display specifications of products, input methods of products, arrangement of the displayed contents and the evaluation of the usage context. Topic 12 (141 essays, 10.04%) ranked third with researches on the survey of hazardous factors at workplaces; analysis on the prevalence of musculoskeletal disorders; and studies on collapses, slips and falls. Other categories of topics are listed in order as Topic 10 (125 essays, 8.9%), Topic 6 (120 essays, 8.55%) and Topic 4 (115 essays, 8.19%).

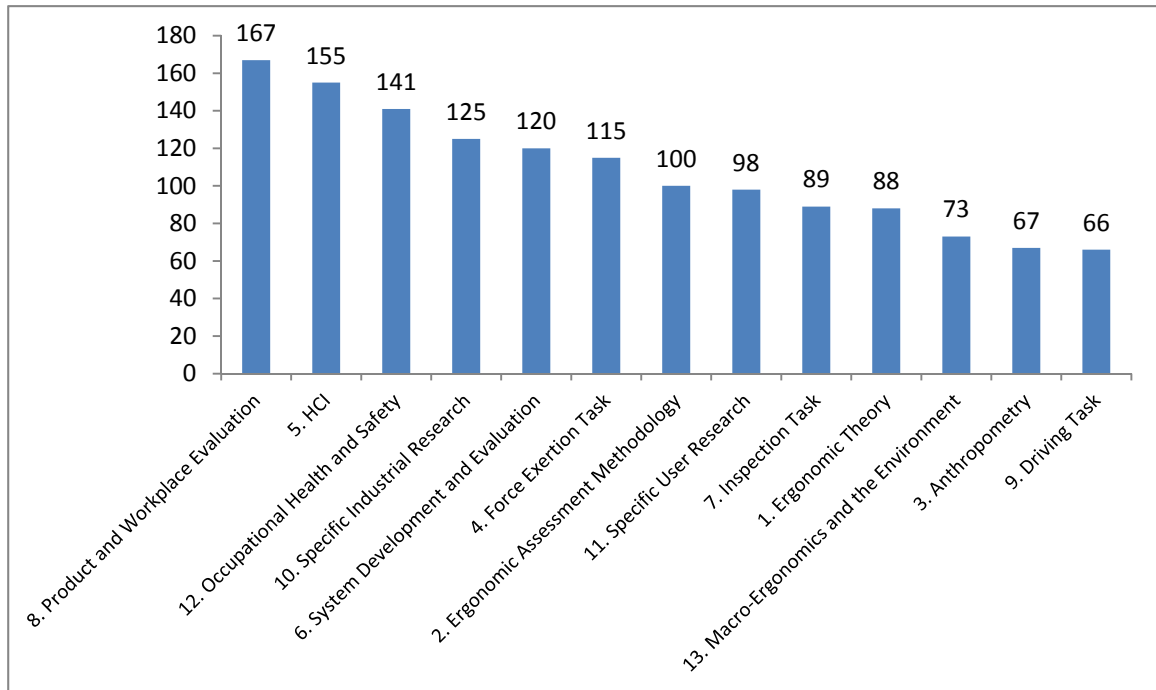


Figure 3. The quantity of essays published in each category of topics.

### Trends in the changes of HFE research topics

Based on the 1st period, the changes in the quantity of essays in each of the topic categories during the 2nd to 5th periods are analyzed. It can be observed that essays in Topic 5, Topic 12, Topic 10, Topic 11, Topic 6, Topic 9 and Topic 13 show positive growths, in which publications in Topic 5 have the most significant growth with an increase of 65 essays between the 1st and 5th period; followed by Topic 12 with an increase of 59 essays compared to the 1st period and then Topic 10 with an increase of 55 essays.

With further analysis on the research contents of essays in Topic 5, it is discovered that the subject of research shifted from the VDT work stations used in the workplace to the variety of electronic information products (such as electronic books, electronic paper and mobile phones) used by the general public. The issues evaluated also altered from the operational performance of the mouse and keyboard and the identification of text to reading comprehension, posture preferences and subjective likings. However, most of the studies are centered on the influences of information presentation (such as the size, color, brightness and background contrast of the text or digital symbols). The researches in Topic 12

always concentrated on both the workplace and fundamental study regardless of the period. On one hand, the effects of various HFE hazardous factors (such as friction at the soles of shoes, falls and shock) were investigated in the laboratories, which led to the creation of theoretical models and checklists; on the other hand, the hazardous elements at a variety of workplaces (such as metal work factories, catering and hotel industries) were evaluated with HFE methodologies for improvement. The subjects of research in Topic 10 focused on medical personnel in the early periods, but this has been replaced by high tech industries such as semiconductors or TFT-LCD manufacturers and control rooms of nuclear power plants in recent years. The research contents for the semiconductors or TFT-LCD manufacturers included musculoskeletal disorders of clean room operators, the evaluation on the wafer transportation operations, the evaluation of clean room shoes (clothes), effects of roster operations and causes of work stress. The studies for the nuclear power plants mostly focused on the human-machine interface, emergency system, emergency operational procedure and personnel reliability in the control room.

The essays in Topic 1 and Topic 7 show negative trends. From this study it is found that there were more researches conducted to create theoretical fundamentals related to HFE (such as the theory of signal detection, decision making process, threshold values, personnel performance and reliability) during the 2nd period and more scholars applied mathematical models such as Fuzzy, Neural Network and Genetic Algorithm to elevate the performance of the automatic identification systems. However, the subject of research later shifted to HCI and occupational safety and health, resulting in the decline of essays in this category. The essays published in Topic 8, Topic 3, Topic 4 and Topic 2 showed variable trends, in which Topic 8 and Topic 3 demonstrated an increasing trend during the 3rd and 4th periods then declined slightly in the 5th period; whereas Topic 4 and Topic 2 showed opposite trends with reductions during the early periods followed by an increase during the 5th period.

## **Conclusions**

By analyzing the periodical publications of researches conducted by permanent members of the EST in this study, it is discovered that the top six periodicals by the quantity of essays published are JCIIE, JOSH, IJIE, JES, P&MS and Applied Ergonomics. For the past 20 years, HFE thesis in Taiwan has been

growing at a rate of 100 essays for every five-year interval on average. The topics have shifted from the fundamental studies on the HFE evaluation methods in the early periods to occupational safety and health in the later periods with more studies on the HCI in recent years. To correspond with the trends in future generations, this study suggests that HFE in Taiwan may emphasize on issues related to HFE engineering, organizational HFE engineering and healthcare in the hope of a brighter future of HFE both in Taiwan and the world.

### **Acknowledgement**

We thank the National Science Council of Taiwan under Grant NSC 102-2221-E-144-001 and The Ergonomics Society of Taiwan for funding this study.

### **References**

- Hwang, S. L., Shih, Y.-C., Cheng, C. H., Lin, C. S., Woon, C. H., Son, H. H., & Cheng, C. J. (1993). The Investigation of Current Researches for Human Factors and Ergonomics. *Journal of Occupational. Safety and Health*, 1(2), 19-27.
- Lee, D. H. (2010). A study on trend of the research papers published in the Journal of the Ergonomics Society of Korea. *Journal of the Ergonomics Society of Korea*, 29(4), 701-707.
- Lee, K. S. (2000). Vision of Asian Ergonomics: The Trend of Ergonomics Development in Korea. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 44(38), 692-695. doi: 10.1177/154193120004403802
- Lee, T. Z., & Wang, J. J. (2000). Ergonomics in Taiwan: The present and future. *Journal of Ergonomics study*, 2(1), 1-10.
- Waterson, P., Falzon, P., & Barcellini, F. (2012). The recent history of the IEA: an analysis of IEA Congress presentations since 1961. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41, 5033-5036.
- Waterson, P., & Sell, R. (2006). Recurrent themes and developments in the history of the Ergonomics Society. *Ergonomics*, 49(8), 743-799.
- Zavod, M., & Hitt, J. M. (2000). Summary of the publishing trends of the Journal of Human Factors from 1988-1997. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 44(33), 6-108-106-111.

# 科技部補助計畫衍生研發成果推廣資料表

日期:2014/08/04

科技部補助計畫	計畫名稱: 我國人因工程二十年之論文發表主題調查與分析
	計畫主持人: 林志隆
	計畫編號: 102-2221-E-144-001- 學門領域: 人因工程與工業設計
無研發成果推廣資料	

102 年度專題研究計畫研究成果彙整表

計畫主持人：林志隆		計畫編號：102-2221-E-144-001-					
計畫名稱：我國人因工程二十年之論文發表主題調查與分析							
成果項目		量化			單位	備註(質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等)	
		實際已達成數(被接受或已發表)	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比			
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	0	0	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力 (本國籍)	碩士生	2	2	100%	人次	
		博士生	1	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	1	1	100%	篇	已將研究成果投稿於 Ergonomics 期刊, 現正審查中。
		研究報告/技術報告	1	1	100%		
		研討會論文	1	2	100%		研究成果發表於 the 5th Asian Conference on the Arts and Humanities(ACAHA2014), Osaka, Japan.
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力 (外國籍)	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		



<p>其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)</p>	<p>過去二十年來，國內人因工程論文每五年均以增加 100 篇的速度在成長，主題從早期著重人因工程評估方法等基礎研究，後來偏重於職業安全與衛生，以及近年的 HCI 主題，均與國際熱門議題有高度關聯性。未來，因應時代的趨勢，本國人因工程建議可多著力於認知人因工程(縮短服務業從業人員能力與工作需求之間的差距)、組織人因工程(協助企業得以快速調整組織來因應市場需求)以及保健(人口老化的影響)等相關議題上，以期人因工程在本國與國際間持續發光發熱。</p>
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	成果項目	量化	名稱或內容性質簡述
科 教 處 計 畫 加 填 項 目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與(閱聽)人數	0	

# 科技部補助專題研究計畫成果報告自評表

請就研究內容與原計畫相符程度、達成預期目標情況、研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）、是否適合在學術期刊發表或申請專利、主要發現或其他有關價值等，作一綜合評估。

## 1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

達成目標

未達成目標（請說明，以 100 字為限）

實驗失敗

因故實驗中斷

其他原因

說明：

## 2. 研究成果在學術期刊發表或申請專利等情形：

論文： 已發表  未發表之文稿  撰寫中  無

專利： 已獲得  申請中  無

技轉： 已技轉  洽談中  無

其他：（以 100 字為限）

研究成果已投稿 Ergonomics 期刊，現正審查中。

## 3. 請依學術成就、技術創新、社會影響等方面，評估研究成果之學術或應用價值（簡要敘述成果所代表之意義、價值、影響或進一步發展之可能性）（以 500 字為限）

EST 於 2013 年屆滿成立 20 周年，相較於其他各國雖然起步較晚，但這些年來在產官學研各界人士持續努力下，不管在職業衛生與安全、工廠效能提升、學術論文發表各方面均有顯著的貢獻。本研究透過分析 EST 永久會員所發表的期刊論文後發現，論文發表總數前六名的期刊分別為 JCIIE、JOSH、IJIE、JES、P&MS 及 Applied Ergonomics。過去二十年來，國內人因工程論文每五年均以增加 100 篇的速度在成長，主題從早期著重人因工程評估方法等基礎研究，後來偏重於職業安全與衛生，以及近年的 HCI 主題，均與國際熱門議題有高度關聯性。未來，因應時代的趨勢，本國人因工程建議可多著力於認知人因工程（縮短服務業從業人員能力與工作需求之間的差距）、組織人因工程（協助企業得以快速調整組織來因應市場需求）以及保健（人口老化的影響）等相關議題上，以期人因工程在本國與國際間持續發光發熱。