出國報告（出國類別：其他）

2014 亞洲科學園區協會(ASPA)
伊朗年會暨世界科學園區協會(IASP)
卡達年會行程出國報告

服務機關：科技部南部科學工業園區管理局、科技部中部科學工業園區管理局、科技部新竹科學工業園區管理局

姓名職稱：陳俊偉/局長、許增如/投資組組長、王永壯/局長、陳淑珠/主秘、鍾幸如/ 科長

派赴國家：伊朗及卡達

出國時間：中華民國 103 年 10 月 12 至 23 日

報告日期：中華民國 103 年 12 月 23 日

摘要

科技部南部科學工業園區管理局(以下簡稱南科管理局)結合財團法人金屬工業研究發展中心(以下簡稱金屬中心)全力推動「南部生技醫療器材產業聚落發展計畫」,第一期計畫以新台幣11.71億元經費引進生技醫療器材產業，在南科高雄園區打造最具國際競爭力的醫療器材產業聚落，第二期四年計畫亦已於102年6月啟動；至103年11月止累計已有48家廠商進駐南科，創造超過685個就業機會，形成了醫材產業聚落。

今年亞洲科學園區協會(ASPA) 年會於10月15至18日在伊朗設拉子舉辦，緊接著10月19至22日世界科學園區協會 (IASP) 年會在卡達杜哈舉行，本次由南科管理局陳俊偉局長與投資組許增如組長、中科管理局王永壯局長、竹科管理局陳淑珠主秘、鍾幸如科長、金屬中心陳進明副執行長、黃博偉組長等7人一同參與年會。

南科共計在ASPA年會發表兩篇論文報告，題目分別是「南科如何建構創新驅動的醫材產業環境」(Building Ecosystem to Spark Innovation-Based Growth in Medical Devices Industry in Southern Taiwan Science Park)，及「如何發展永續綠色園區—以南科為例」(How to Develop a Sustainable Green Science Park, an Example of STSP)，此外，陳俊偉局長及王永壯局長也分別應邀擔任 ASPA「科技管理與產業聚落」(Technology Management and Industry Clusters)及「知識型經濟範例及開放性創新」分項會議主持人，會場得到許多與會代表的迴響。

在 IASP 年會部分，獲選之論文題目為「促進產學合作機制—南科創新服務平台」(The Cooperative Mechanism for the STSP Innovation Services Platform that helps to Link Enterprises to Academia)，由南科投資組許增如組長擔任發表人，內容以南科創新服務平台為例，探討如何有效地推動產學合作，將單一窗口服務升級為「創新服務平台」，主動提供醫療器材產業發展所需的創新加值服務，鏈結產學研相關資源，包括獎補助、檢測驗證、人才培訓、及行銷拓展市場等，並以鴻君科技股份有限公司為案例，探討創新服務平台如何推動產業、學界、醫界合作，促成傳統產業升級及轉型、成功發展人工牙根產品，以及過程中創新服務平台面臨的挑戰與解決方案，說明科學園區不只是提供場地及服務，也可是創造價值的地方。該論文未發表前已獲各界關注，包括當地媒體「今日卡達」雜誌主動邀約專訪，希望報導台灣科學園區營運模式及南科推動產學合作相關經驗，與當地及中東地區讀者分享，提升南科國際能見度。

此外，為協助南科醫材廠商拓展海外市場，此行亦拜訪伊朗當地通路商 D.G Dena 公司，洽談未來合作可能性。該公司除代理醫療器材、藥品、電子設備、軟體、汽車零組件等相關產品外，同時也是製造商，主要生產注射針滅菌設備、醫療用智慧卡及生理監測數位化等，對於南科廠商進入伊朗市場，無論是認證的取得或是通路的佈建都有一定的幫助。該公司對代理台灣的產品，表達了高度意願，除希望能獲得更多南科醫材廠商的資訊外，也表達對投資台灣中小企業的興趣，希望有更多元的合作模式。

ASPA 及 IASP 分別是亞洲及全世界重要的科學園區組織，今年度年會恰巧先後都在中東地區舉行，透過本次三篇論文發表，代表南科在科學園區的

經營管理與創新產業聚落的營造，獲得國際間的肯定。透過年會與各國代表共同討論分享國際間產業及科學園區的發展新趨勢，並拜訪通路商拓展南科醫療器材在中東市場發展的機會，可以說是收獲豐富。

目　錄

壹、出國目的

目前南科園區所推動的醫療器材產業聚落主要以牙科、骨科與醫學美容為主，透過參與 ASPA 及 IASP 年會，發表南科醫材聚落發展經驗，同時和與會先進共同討論高雄園區醫療器材產業的成果與未來發展策略，提升南科聚落之國際能見度，並增加產業發展經驗、強化聚落發展成果。此行同時結合訪廠行程，拜訪伊朗醫療器材通路商了解當地市場概況及行銷模式，學習相關經驗。

貳、過程

本次行程主要參加 ASPA 及 IASP 年會，並於會中發表論文，同時拜訪伊朗醫療器材通路商。

一、行程規劃

本次參加 2014 ASPA 伊朗年會及 IASP 卡達年會之行程規劃如下：

日期	行程
10/12(日)	◆ 啟程
10/13(一)	◆ 抵達
10/14(二)	◆ 拜訪伊朗通路商 D.G.Dena Co.
10/15(三)	◆ 參加 ASPA 理事會議
10/16(四)	◆ ASPA 年會註冊 ◆ 年會開幕式 ◆ 參加 ASPA 年會(中科王局長擔任 Moderator)
10/17(五)	◆ 醫材計畫論文發表(南科陳局長擔任 Moderator、金工黃組長發表) ◆ 綠能計畫論文發表(南科許組長發表) ◆ 閉幕式
10/18(六)	◆ 年會科技之旅
10/19(日)	◆ 前往杜哈參加 IASP 年會

	◆ IASP 年會註冊
10/20(一)	◆ 參加 IASP 年會 ◆ 年會開幕式
10/21(二)	◆ 醫材計畫論文發表(南科許組長發表) ◆ IASP General Assembly
10/22(三)	◆ IASP 年會閉幕式 ◆ 啟程返台
10/23(四)	◆ 抵台

二、參加人員名單

No.	姓名	職稱	單位
1	陳俊偉	局長	科技部南部科學工業園區管理局
2	許增如	組長	科技部南部科學工業園區管理局
3	王永壯	局長	科技部中部科學工業園區管理局
4	陳淑珠	主秘	科技部新竹科學工業園區管理局
5	鍾幸如	科長	科技部新竹科學工業園區管理局
6	陳進明	副執行長	財團法人金屬工業研究發展中心
7	黃博偉	組長	財團法人金屬工業研究發展中心

各主要行程分述如下：

三、2014 亞洲科學園區協會(ASPA)伊朗年會

今年 ASPA 年會於 10 月 15 日至 18 日在伊朗設拉子舉行， 主題為「科學園區在概念時代的創新與商業化機會(STPs: Innovation & Commercialization Opportunities in the Conceptual Age)」，由伊朗法爾斯科學園區(Fars Science and Technology Park)主辦，共有 15 個國家 400 多人參加這次盛會。

10 月 15 日首先登場的是 ASPA 理事會議(ASPA Board of Directors Meeting)，討論未來 ASPA 發展趨勢與方向，並票選 2016 年之主辦國為印度海德拉巴園區。

10 月 16 日為年會開幕式，正式揭開年會的序幕。開場的 Keynote Speech 主題為「Innovation and Evolution of Science in Shadow of National Independence and International Cooperation」，探討伊朗由於過去的封閉所造成的影響，在創新的過程中，希望提升國際交流與未來國家的創新能量。

大會主要演講者由伊朗現任副總理及太空能源組織負責人 Professor Ali Akbar Salehi 擔任，並邀請來自美國、日本、芬蘭、韓國及新加坡等國的重要園區經營者、學者及企業家匯聚一堂，分享如何藉由運用創造力、創新及設計能力提高競爭力。

本年度 ASPA 年會共有 4 個主要議題(Plenary Session)，包含科學園區與育成中心在概念時代所扮演的角色(Role of STP’s and Incubation Centre in the Conceptual Age)、以知識為基礎的經濟模式與開放式創新(Knowledge-Based Economy Models & Open Innovation)、技術管理與產業聚落(Technology Management and Industry Cluster)、科學園區與區域發展(STP’s and Regional Development)；另外也同時舉辦 5 場專題座談(Mini-Symposium)，討論主題為創新資訊科技概念之商業化(Commercialization of Innovative Information Technology Ideas)、綠色航太科技之商業化(Commercialization of Green Aviation Technologies)、創新生技產品之商業化(Commercialization of Innovative Biotechnology Products)、創新奈米科技產品之商業化(Commercialization of Innovative Nanotechnology Products)、創新綠能產品之商業化(Commercialization of Innovative Green Energy Products)。

其中，中科王永壯局長在「以知識為基礎的經濟模式與開放式創新(Knowledge-Based Economy Models & Open Innovation)」的議題中擔任主持人，針對該場次講者的創新模式，提出不同的問題與看法並加以討論。

10 月 17 日本局則分別於「技術管理與產業聚落(Technology Management and Industry Cluster)」議題與「創新綠能產品之商業化(Commercialization of Innovative Green Energy Products)」專題座談中各發表一場次論文報告。

(一) 技術管理與產業聚落議題論文發表情形

本議題由本局陳俊偉局長擔任主持人，南科在此議程中發表的論文題目為「在南科園區建構生態系統激勵以創新為基礎的醫療器材產業發展」(Building Ecosystem to Spark Innovation-Based Growth in Medical Devices Industry in Southern Taiwan Science Park)，由金屬中心黃博偉組長代表發表，在陳局長的主持下，台下的聽眾引發熱烈的討論與迴響。

論文內容摘要如下：

南部生技醫療器材產業聚落發展計畫在南科管理局的推動下，第一階段(2009-2012 年)已成功協助傳統產業技術升級，以「傳產升級」為主要策略，成功吸引 36 家廠商進駐園區並投資設廠，廠商已逐步開發出自有品牌，在 2013 年度產值更達 24.8 百萬美元，已逐步形成產業聚落，第二期計畫(自 2013-2016 年)重點在於建置臨床創新 ecosystem，此外，為了建構適合新創事業發展創新醫材的環境，「南部生技醫療器材產業聚落發展計畫補助實施要點」在 2013 年進行了修正，將補助延伸至創新醫材研發之範圍。

本研究中探討了在二期計畫中建構臨床創新 Ecosystem 的 6 項重要元素：人才培

訓、技術整合、育成中心、醫療器材法規諮詢與產品檢測、創投資金以及政府資源。醫療器材產品的新概念經常在研發人員與臨床醫師的交流中出現，因此，南科管理局為研發人員及醫師設計了一系列的訓練課程以獲取最新的技術及知識。而整合臨床需求及技術也是創新醫療器材產品的關鍵要素。育成中心的設立則是為新創事業提供商務諮詢與輔導之服務。在醫療器材產品上市前，法規諮詢與產品檢測皆為必要過程，此外，創投資金與政府資源更支持了創新醫材產品的開發。因此，上述的 6 項元素建構出「臨床創新 Ecosystem」。2013 年度共有9件創新計畫獲得補助，補助金額約429千美元，計畫主要利用光電監測系統、醫學影像及微創手術等創新概念，搭配臨床醫師經驗，開發出更符合醫師手術操作、貼合患者骨整合情形及即時監控病情的創新醫療器材，最終將產生技術移轉 9 件，微創手術醫療器材佔 4 件、光電監測系統佔 3 件、醫學影像開發佔 2 件，所開發產品與區內廠商媒合已有 2 件。因應產業高值化，南部科學園區成立計畫辦公室，必需滿足以創新產品上市法規、技術移轉模式及專利評估的需求，主動協助產業媒合與創新。藉由與醫師的合作機制，將我國臨床醫學的優勢導入醫療器材創新與高值化。

(二) 創新綠能產品之商業化專題座談發表情形

本專題座談由本局投資組許增如組長以「如何發展永續綠色園區—以南科為例」為題，與其他園區代表分享南科發展綠能低碳產業聚落的發展經驗。首先由台灣的地理交通位置、人口分布等基本資料開始介紹，接著進入主題，說明台灣以 IT 產業著名，依據 IMD 世界競爭力評比，台灣在科技基礎建設、科學

基礎建設、及創新因素部分均名列前茅，僅次於美國、日本、德國等已開發國家。台灣完善的基礎建設及產業發展環境，提供產業發展的良好基礎。然而因為溫室氣體排放，全球遭逢暖化的威脅。最快不到 2047 年，全球有將近 30 億人口會受到氣候變遷的威脅。氣候暖化造成海洋冰塊溶解，連北極熊都會遭逢棲息地減少，而在海中遭遇危險。

當我們探究如何控制溫室氣體排放，必須先知道溫室氣體的來源。通常有兩個途徑，一是自然排放，像是植物或是森林會自然排放二氧化碳。另一種是透過人類活動排放，這有好多種方式。我們在探究如何控制溫室氣體排放，指的是如何控制及減少人類活動所造成的溫室氣體排放。根據世界銀行的排名，前三大人均二氧化碳排放國家，分別是澳洲、美國和加拿大，台灣大概排名第二十二，伊朗約七十四。

假如我們比較美國及台灣 2012 年的溫室氣體排放，美國主要的溫室氣體來源是來自電力生產，對照台灣，主要的溫室氣體排放來源是因為工業。南部科學工業園區，做為台灣主要的工業生產基地之一，有責任減少溫室氣體排放及減少氣候暖化效應。南科目前是台灣最大的科學園區，全年陽光普照，包括台南及高雄兩個基地。主要產業是半導體和光電業，產值占全園區年產值的百分之九十。截至 103 年 9 月，南科引進 361 家廠商，成功為南台灣創造將近八萬個工作機會，這個數字還會持續成長。102 年整個園區產值超越 20 億美元，園區廠商的產品銷往全世界。

雖然科學園區的主要業務還是生產製造，但是科學園區有責任保護環境和永續性。南科目前正在執行的計畫包括三個部分：綠色產業聚落、綠色環境和綠色文化。首先在綠色產業聚落部分，南科引進 29 家綠能廠商，產業供應鏈相當完整。從上游原料和零組件，到下游產品及設備，綠能廠商可以從南科產業聚落，

得到所有可能的零件及技術服務。南科也會持續引進更多廠商，擴大綠能產業聚落。

南科是全世界最強的 TFT-LCD 產業聚落。根據 2013 年台灣在 TFT-LCD 面板產品的市占率，台灣產品約占 33%，產值約 420 億美元。在南科生產的 TFT-LCD 面板產品，又占所有台灣產品的三分之一。南科也是最閃耀的光電能源產業聚落，當我們談到光電能源產業，指的是 LED 產業和太陽能模組產業。台灣大概全球排名第二，市占率約為 15%。南科對台灣產值的貢獻約為 22%。

南科不但是台灣最重要的綠能產業聚落，在全世界也非常重要。這原因主要是因為南科提供綠能產業發展所需要的產業輔導平台，這平台包括計畫獎補助、創投資金媒合、人才培訓計畫、和產品認證及行銷等，所有可能的資源都可以透過南科產業輔導平台取得。簡單地說，南科創造綠能產業發展的良好環境。
南科第二個策略是綠色環境。科學園區的目的之一在於保護環境及其永續性，這從潔淨生產開始，避免製造各式污染源。假使廢棄物及污染的產生無法避免，我們會鼓勵我們的廠商盡其可能減少廢棄物及污染的排放。

當我們談到溫室氣體排放，交通運輸也占很大比例。南科發展綠色交通網絡，在園區內，我們有免費的巡迴巴士，連結火車站到園區各個角落。所有的員工和訪客在園區內，都可以搭乘這個免費的公共運輸系統。南科也沿著園區內的主要道路，建造長達 65 公里的自行車道，自行車道兼具交通及休閒遊憩的功能。南科也鼓勵園區廠商興建綠建築，已經有六家公司取得「綠色工廠」認證，11 家得到鑽石級綠建築的肯定。

南科也保留綠色土地給動物和鳥類，整個園區建築覆蓋率小於 50%，綠覆率達到 46%以上。園區內有 17 座公園。年會舉辦地設拉子也有很多公園，這些公園

兼具景觀及遊憩的功能。南科還有 30 公頃的生態保護區，已發現有 66 種鳥類棲息在此，還包括稀有鳥類像是環頸雉和燕鴴等。

第三個策略是創造綠色文化，南科試著將綠色園區的想法變成園區的文化 。南科每年為園區員工及鄰近學校的學生，設計及舉辦很多生態教育課程及活動。南科種了很多樹，也鼓勵園區廠商一起種樹。更有甚者，南科鼓勵園區廠商去購買鄰近地區所種植的新鮮蔬菜和水果，這比去購買遠地生產的蔬菜及水果，可以有效地減少碳排放、達到碳平衡。我們相信透過這三大策略，南科終究會達到綠色永續的目標，盡其所能保護好整個環境。

雖然南科已經成立十八年了，南科的現在和過去已經非常不一樣了。在 2013 年，台南和高雄兩個園區，都被台灣政府認證為「永續生態社區」，這也是台灣僅有兩個被認證的永續生態社區，證明南科在推動綠色園區所努力的成果。我們希望從潔淨生產開始，創造一個更乾淨的環境，給南科社群、包括廠商及員工更舒適、幸福的生活，達到「快樂南科」的目標。發表後反應相當熱烈，也引發了許多的討論。

ASPA 大會過程中，台灣三園區也積極與其他國家園區代表互相交流與認識，增加未來合作的機會。

四、2014 世界科學園區協會(IASP)年會

今年 IASP 首次在阿拉伯國家舉辦，於 2014 年 10 月 19-22 日由卡達科技園區主辦(Qatar Science and Technology Park, QSTP)，今年年會的主題是「科學園區：啟動技術的發源地(Science Parks: Where Technology Goes to Work)」，包含三大課題：扮演科技發展催化劑角色之科學園區(Role of STPs as technology development catalysts)、產學合作模式及科學園區能夠或應該扮演的角色(Models of cooperation between universities and companies and the role that STPs can or should play)、科學園區及其園區廠商：科學園區主要導向及園區內的大型企業或跨國公司，科學園區能夠或應該扮演的角色？科學園區如何與大型企業或其進駐廠商建立更緊密的連結？(STPs and their resident companies: STPs are mainly oriented and the role that STPs can or should play role of large corporations and multinationals in STPs? How can STPs establish stronger links with big corporations and amongst its tenant companies?)

本次會議共計約有超過 500 多位參加者與會，由 YouTube 聯合創辦人 Chad Hurley 擔任開幕主講者，分享創辦 YouTube 的經驗及發展過程。Chad 表示「Youtube 的經驗讓我知道，有相同願景的一群人能使世界不同，我相信這是所有科學園區想達成的目標」。也因為這個共同的願景，使得各科學園區及研究機構一同聚集在首次舉辦 IASP 年會中東地區，分享自己的創造技術、經營方式及管理方法。

(一) 和知識創造者合作：和大學及研究中心的合作模式」議題論文發表情形

南科本次以「南科創新服務平台串聯企業與學術單位合作之機制(A Cooperative Mechanism for the STSP Innovation Services Platform to Link up With Enterprises and Academia)」為題發表，該場次之議題為「和知識創造者合作：和大學及研究中心的合作模式」(Cooperating with Knowledge Creators: Models of Collaboration with Universities and R&D Centres)，主持人來自俄羅斯，由南科投資組許增如組長發表，同場其他發表人還有來自西班牙、南非、科威特大學研究園區的代表。

發表的內容分成五個部分：引言、南科簡介、新型態的單一窗口服務、個案研究及結論；細節摘要如下：如何促進產業界及學術界的溝通及合作，一直是全世界共同面臨的課題。從學術界來看，學界比較關心先進科技、基礎研究及論文發表，產業端則比較在乎成熟的技術、短期可回收的利潤及市場競爭。不同的觀點，使得產學合作顯得困難。

如何解決這個問題？我們不能忽視環境因素，因為任何人類問題都不可能從環境中孤立出來。我們用「生態系統」(ecosystem)這個概念來代表整個環境，在Moore (1996)所提出的商業環境中，有三種類型的行為者：

- **支配者(the dominators)**

支配者的角色包含透過整合策略，以支配其在生態系統中的利基及利益，用以

控制其網絡內最大量的利益，從中獲取自己的利益，通常也被稱為「價值支配者」(value dominator)或「聚落的主宰」(hub landlord)，試圖為環境網絡中創造最大價值及利益，而不重視分配。

- 基石(keystones)

這種類型的參與者很明顯地扮演了在網絡內兼具創造與重新分配價值的角色。相對於「支配者」，他不會試圖控制整個網絡及其參與者，但會試著在一些節點中建立自己的地位，並擔任領導。基石時常憑藉著平台策略，並透過使用某些資源使他們有機會從其他網絡參與者的貢獻中獲得利益。與生態系統中的其他成員相比，他們通常採取「雙贏」的態度。

- 利基者(niche players)

環境中有很多規模小且追求專業策略的參與者，稱之為「利基者」。他們在生態系統的價值創造中占很大部分。透過平台取得的資源及基石提供的機會，使利基者可以發展新產品或服務。利基者大部分也仰賴生態系統所創造的價值。

商業生態系統是由顧客、市場行銷人員、及他們的產品、服務和技術所組成。這些要素構成一個平台，由生態系統內的行動者及活動所環繞。我們通常用這個模型，解釋大企業如何和他分屬不同階層的夥伴及整個生態系統互動。商業生態系統的核心要素包括產品、服務和技術。假使把這些要素擴大到科學園區，科學園區的管理單位可以扮演支配者的角色。科學園區可以藉由整合既有商業生態系統的創新活動來創造價值，藉由科學園區提供的創新服務平台，將過去單一窗口服務升級，鼓勵更多創新、整合及彼此合作，來幫整個網絡創造最大的價值。

為了發展高科技產業，台灣有三個科學園區。南科面積最大，包括兩個基地，

一個在台南、一個在高雄。在台灣，科學園區是由公部門營運，稱之為管理局。管理局隸屬於科技部，而科技部有三大使命：分別是制定科技政策、支持學術研究及發展科學園區。台灣的科學園區以完善的基礎建設與環境，享譽國際。然而面對全球競爭，台灣科學園區在國際間的優勢，是否足以維持並協助其廠商持續發展？該做些什麼來創造園區價值及維持園區的競爭力？

南科發展出一套平台，稱之為「單一窗口」(one stop service)。在過去，單一窗口是指政府服務的單一窗口，透過這個唯一的窗口，可以取得政府各式各樣的服務及協助。但是這種型態的單一窗口有點被動，必須等人上門才提供服務。現在，南科發展新型態的單一窗口，稱之為「創新服務平台」(innovation service platform)，可以主動提供服務。這種型態的服務對醫療器材產業特別有幫助，因為這是台灣近年新興發展的產業，台灣政府承諾要協助醫療器材產業的發展，而南科的創新服務平台，有一部分，就是要協助鏈結產業與學術界合作。

透過研發獎補助，南科提供必要的誘因鼓勵產學合作。南科的策略有兩個面向：行銷產品(marketing products)及行銷創意(marketing know-how)。南科協助產業發展品牌、商譽及拓展市場。因為南科和周遭研究型醫院的合作關係，南科創造一種創新合作的環境，刺激更多臨床應用上的創意，這樣基礎研究的成果就可以成功地商品化。行銷創意(marketing know-how)在協助產業各式各樣的需求，像是產品認證及人才培訓。

在醫療器材產業，從創意(idea)到發展成產品，是一個漫長的過程。有很多法規、測試及認證的藩籬必須突破及克服。創新服務平台(innovation service platform)包括三個部分：技術媒合服務平台、臨床資訊平台及產品行銷平台。每一個部分都在協助解決產業化過程中，可能遭遇的困難。這有點像新婚夫妻對整個結婚程序不熟悉，這個服務平台的暱稱就叫做婚禮顧問公司服務(wedding company services)。透過南科的「婚禮顧問服務」，希望協助產業排除萬難、通往成功之路。

當然創新服務平台必須鏈結所有可能的資源，為整個生態系統網絡汲取並創造最大的價值。這包括政府獎補助、來自學界的人才及基礎研究、醫院的臨床研究資源及臨床應用的創意、國家實驗室的核心研究設施及認證服務，產業也需要來自公司部門的財政支援。南科對醫療器材產業，有個特別的計畫，從 2009 到 2014 年，南科已經提供 5 千萬美元的獎補助。

南科協助園區廠商拓展國際市場，南科提供醫療器材展品的展示地點，稱之為「展示室」(show room)，展示所有園區聚落的醫療器材產品，希望達到「一次購足」(one-stop shopping)的目的。此外，南科還每年補助園區廠商參加國際展會，今年就參加了在中國舉辦的華南口腔展、越南醫療器材展及美國的生技展。

透過平台及南科許多的努力，現在在南科有個創新產業聚落，目前引進 48 家廠商，他們大部分生產齒科、骨科、和醫學美容產品。其中 10 家產品已經拿到美國 FDA 的許可，15 家取得歐盟 CE 的認證，這代表他們的產品已經可以販售到全世界大多數的國家。在過去五年，聚落的產值逐年成長，不只銷售額大幅成長，引進的公司數目及投資金額也快速成長。

以鴻君科技公司(Hung Chun Bio-S)為例，可以說明南科做了些什麼。鴻君公司以前是在高雄岡山地區的鴻君模具公司，是做螺絲螺帽產品。60 年前，高雄岡山地區成功發展螺絲螺帽產業，市占率一度曾達全球百分之三十。隨著全球化的發展，鴻君面臨來自其他發展中國家的低價競爭，鴻君開始思考如何產品升級、創造更多的價值。

南科提供的服務平台協助地方螺絲螺帽產業升級與轉型。鴻君和台北醫學大學合作，發展生醫植牙牙根和微創手術器械；鴻君也和高雄大學合作，發展材料工程和工程設計。南科提供計畫獎補助，連結廠商和學研機構，鼓勵他們發展先進高品質的產品。南科的服務平台，成功地協助鴻君公司轉型升級為台灣第一個人工牙根製造商。該公司於 2011 年取得歐盟 CE 及 ISO13485 認證，2012 年取得美國 FDA 販售許可。今年鴻君全新建造的廠房在高雄園區落成，產品不只出口到中國，也將販售到世界各個角落。

醫療器材需要非常精細複雜的技術及產品檢驗，再加上販售到市場有很多門檻必須克服，對台灣業者來說，最後上市行銷這個階段並不容易。但是南科所提供的服務平台，成功地協助廠商，由單純的螺絲製造商，轉型升級為高階牙科醫療器材製造商。

最後，雖然創新服務平台從 2008 年開始推動，仍然有許多需要改進的地方。此平台屬於任務導向，因為政府預算和資源有限，一開始需要政府投入以發揮示範效用，等穩定運作後，可以轉由民間部門來經營，才可永續經營。雖然南科的創新產業服務平台，成功地鏈結產業及學術界，透過南科的服務，希望協助廠商創造更多價值。科學園區不只是提供土地及服務，科學園區也可以創造價值，協助園區醫療器材廠商邁向成功之路。

(二) 今日卡達專訪

這次參與 IASP 年會獲得今日卡達(Qatar Today)雜誌的青睞，特別邀請南科陳俊偉局長、許增如組長及中科的王永壯局長參與專訪。訪談內容由科技部所屬的台灣三大科學園

區成立的歷史及創造台灣半導體產業及光電產業的奇蹟開始，接著提及本次IASP 的會議主軸之一的學研及企業互動的模式，台灣已經推動 30 年的時間，並特別強調台灣的規模和瑞士一樣是一個小國家，政府需要公平及有效地分配資源；另外，台灣沒有天然資源，因此透過出口來獲利，當製造商賺到錢，這是投資回研發，從而維持不依賴政府的資金。而這也造就了完整的產業鏈與生態系統。台灣科學園區的成功始於矽谷的經驗學習並加以複製來台灣，使台灣成為電子產業的王國，再加上週邊鄰近台灣最好的大學，創造了完整的創新產業環境。


el which has earned Taiwan its place among the top five machinery exporting countries in the world. "When manufacturers earn money, it is invested back into R&D and thus sustains itself without just depending on government funds." It all began back in the day with the ubiquitous semiconductor. "The first STP wanted to recreate the Silicon Valley experience in Taiwan and hence was established near two of the biggest universities in the country. It was also in close proximity to ITRI, the Industrial Technology Research Institute. The primary sectors when we started off were semiconductors and electronic components and they still make up 90% of our annual sales," says Hsu. In southern Taiwan, with two large industry clusters around integrated circuits and opto-electronics, the annual revenue is in the league of $20 billion (QR73 billion) and involve the combined efforts of more than 80,000 people who work with the 360 companies there.

Such is their two-fold strategy, according to Hsu. "In the past the acent was on attracting foreign companies to build manufacturing capability and boost development. But now we are also sponsoring companies to create enterprises in the STP through our incubation and innovation centres." This is evident from the fact that less than 15% of the companies based out of the southern STP are foreign-based.

Director-General of the Central Taiwan Science Park Wayne Wang, who heads the STP that houses several high-tech industries like ICT, machinery and biotech, says that Taiwan's big plus points are its strong regulation and legal environment and large human resource pool, most of whom are university-educated, and the national focus on R&D. Three percent of the country's GDP is invested into R&D and the importance of getting returns is highlighted at every stage, right from the university level where professors ask their charges to think long and hard about how their research can contribute to the larger picture. In this tech park, more than 30% of the 120 companies are MNCs, mostly from Japan, Hong Kong, US and Germany. "We are constantly learning from their experience and innovation and this has resulted in a local supply chain giving plenty of local companies an opportunity to improve their capability," he says. While the STPs keep a close eye on several KPIs like annual revenue, number of personnel, talent cultivation, number of new companies and their investment in R&D, they also know they have a big role to play outside in advising other sectors of government that can affect some of the external factors that influence their functioning. "For example, early-stage tech research is very important. Universities here do a lot of research but they need to think about how to transform it into a technology and then a new industry," says Wang. The government encourages this by generously financing university research grants and allowing them to own their work.

"THE MINISTRY OF SCIENCE AND TECHNOLOGY HERE HAS A THREE-PRONGED STRATEGY THAT PROMOTES SCIENCE AND TECHNOLOGY INNOVATION, ACADEMIC RESEARCH AND THE DEVELOPMENT OF STPS."

CHUN-WEI CHEN (Centre)
Director-General
Southern Taiwan Science Park Bureau
with
WAYNE WANG
Director-General
Central Taiwan Science Park, and
ANDREA HSU
Director of Investment Services Division
Southern Taiwan Science Parks Bureau

現在台灣也開始投入創新產業的育成模式，試著以創新創業的模式，帶來產業另一高峰。台灣的優勢是強有力的監管、法律環境和人力資源，在科學園區中，大部分的員工都受過大學教育，在 120 家企業中佔30%以上都是跨國公司，這些企業主要來自日本、香港、美國和德國。台灣現正不斷地從經驗和創新中學習，並使得當地的供應鏈提供大量的本地企業有機會提高自己的能力。而科學園區保持密切關注的幾個關鍵績效指標為：年收入、員工數，人才培訓、新創公司的數目和投資研發。

五、參訪醫療器材通路商

本次除參與年會外，同時安排參訪行程，拜訪伊朗當地醫材通路商，提供園區

廠商日後更進一步之合作及國際交流之機會,同時介紹南科園區之優勢與特長,鼓勵當地企業來台投資,將南科醫療器材專區進一步推廣至世界舞台。而參訪後亦將與其保持聯繫,為日後可能的合作與交流奠定基礎。


■ 公司名稱:D.G.Dena Co.

■ 拜訪日期:2014 年 10 月 14 日

■ 主要營業項目:醫療器材、藥品、電子設備、軟體、汽車零件以及通訊等高科技產品之註冊與進出口業務

■ 接待人:Mr. Shiva Torkabadi, Commercial Manager
Dr. Muhammad Ali Eskandari, Sales Manager
Mr. M Eskadari, President / CEO

■ 公司簡介

D.G. DENA 公司總部設於伊朗設拉子,工廠及研發部門位於西拉特區,是間多方面經營的通路商,實收資本額達 340 萬美元,共有 55 位員工,研發人員有 10 人。

該公司成立已超過 20 年,在伊朗主要經營包含醫療器材、藥品、電子設備、軟體、汽車零件以及通訊等高科技產品之註冊與進出口業務,並劃分為醫療器材的製造與通路兩大部份,與歐美公司有合作關係,主要提供的

服務有：產品認證、銷售、產品售後服務以及支援等。

D.G. DENA 公司代理的許多醫療器材及藥品皆已成功申請通過伊朗衛生部核准，目前正積極拓展歐美產品進入伊朗市場，並接受合資、業務代表或代理經銷等合作方式。

■ 主要產品

針滅菌系統

無痛痔瘡

電腦化 ECG 系統

智能醫療卡系統

■ 拜訪目的

D.G. DENA 公司為伊朗當地通路商，有通路布建與取得伊朗認證的能力，可協助申請醫材產品在伊朗之認證，亦可代理南科廠商產品，此行針對南科醫療器材產業聚落作深入的介紹與說明，對於未來園區廠商進入伊朗市場將有所助益。

■ 互動與交流

本次特別介紹南科園區牙科、醫學美容、體外診斷及骨科等醫材廠商的產品，並透過南科簡介使其對台灣科學園區有更多的認識，經過初步洽談後，D.G. DENA 公司對於園區產品代理及技術合作有相當的興趣，若往後

有機會，將邀請該公司來台參訪，進行通路或是技術交流，並邀約南科廠商媒合及安排參訪，與台灣廠商進行交流，為聚落廠商尋找商機。

參、心得

本次「2014 亞洲科學園區協會(ASPA)伊朗年會暨世界科學園區協會(IASP)卡達年會行程」心得如下：

一、透過論文發表，展現園區實力，促進國際交流

本次出國行程參與 2014 年亞洲科學園區年會(ASPA)與世界科學園區協會年會(IASP)，並發表了南科推動綠能及醫療創新產業聚落共計三篇論文，且陳俊偉局長與王永壯局長亦應邀擔任 ASPA 分項會議主持人，而南科推動產業創新及產學合作之成果，亦獲「今日卡達」(Qatar Today)雜誌專訪，此行對提升園區國際能見度，成果豐碩。

ASPA 及 IASP 分別是亞洲及全世界重要的科學園區組織，本次共計三篇論文獲選發表，代表南科在科學園區的經營管理與創新產業聚落的營造，已經獲得國際間的肯定，透過年會與各國代表共同討論分享國際間產業及科學園區的發展新趨勢。

在面對全球經濟局勢變化、環境變遷、糧食危機，各國紛相發展綠能產業等情勢下，演講者大都主張開放創新的態度是應打破藩籬，在保護自身的利益下，增加彼此合作機會及空間，共同研討出合適產品以創造市場價值及雙贏局面，創造雙贏。

二、透過通路商拜訪，瞭解海外市場，協助廠商打入國際市場

為了協助南科醫療器材廠商拓展海外新興市場，此行亦拜訪了伊朗當地通路商 D.G Dena 公司，洽談未來合作可能性，對於南科廠商進入伊朗市場，無論是認證的取得與通路的佈建都有一定的幫助，該公司對代理台灣的產品也表達了高度的興趣。該公司除希望能獲得南科醫材廠商的介紹外，也展現出對投資台灣中小企業的興趣，希望有更多元的合作模式。此次透過通路商的拜訪，拓展南科醫療器材在中東市場發展的機會，並了解當地的人文與風情，有助台灣產業技術轉移及通路佈建。

肆、附件

一、2014 IASP 論文全文

A Cooperative Mechanism for the STSP Innovation Services Platform to Link up With Enterprises and Academia

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Executive Summary

How to promote effective cooperation between academia and enterprises has long been an important issue of governmental policy study, and the challenges lie in imbalance between the focus of academia on advanced technology, academic research, and research institutions, and enterprises. Thus, more pragmatic work is required to serve the bridge to help communication between the public and private sector. Innovation services platform is a commonly addressed theme, but it lacks effective discussions on how to implement and combine the planning of science parks. This study attempts to examine and understand how the Innovation Services Platform did to promote the cooperation among academia, the industry, and the medical circle and lead to successful market entrance from the development perspective of dental implants and solutions provided by the Innovation Services Platform during the operation process by examining the case Hung Chung Bio-S. Co., Ltd. at the STSP.

Keywords: Southern Taiwan Science Park (STSP), Medical Device, industry cluster

1. Introduction

Methods to promote effective cooperation between academia and enterprises have long been an important issue of governmental policy study. Challenges lie in the imbalance between the focus of academia on advanced technology, academic research, and research publication as well as the emphasis of enterprises on the application of mature technology, short-term profit making, and market competition. Hence, barriers and the failures to communicate between both parties arise accordingly and indirectly hinder overall national industrial development. As shown in the literature review, one of the main purposes for establishing science parks is to serve as an interface platform to promote cooperation between the above two parties, academia and the industry. Unlike the research and development-based model of science parks adopted by the US and Europe that are mostly set up with the aim among academic institutes or private units to facilitate cooperation between academia and the industry, science parks in Taiwan, at present, operate with the main goal of providing a supplementary function of manufacturing with research and development functions while the central government plays the core role of initiating research and development. Thus, in terms of the facilitation of cooperation, more pragmatic work is required to serve as a bridge to promote communication between public and private sectors in order to respond to their unique responsibilities and work content.

Established in 1997, the Southern Taiwan Science Park (STSP) consists of Tainan Science Park in Tainan and Kaohsiung Science Park in Kaohsiung, respectively. Although Kaohsiung Science Park was originally designated to be the cluster site for the optoelectronics industry, due to the overall climate and resource competition, great barriers were encountered at the initial development stage and after considerations of local resources and technologies, the future development objective of the STSP Administration, city governments, and local academic and research institutions changed to focus on the biomedical device industry. The concept to develop the biomedical device industry was inspired by the combined strength of steel-making and precision machining companies in Southern Taiwan as well as recent technology breakthroughs and interface integration that are required throughout the entire process ranging from product concept, actual production, to market entrance. Resources come from different public and private sectors and no single agency from business, academia, or governments is able to integrate all players within existing administrative boundaries. As a result, the STSP Administration developed the concept of an interface organization by establishing the "Innovation Services Platform" as the core for resource search, resource integration, and one stop services.

The Innovation Services Platform is a commonly addressed theme in relevant literature, but there is a lack of effective discussions on how to implement and combine the planning of science parks mainly because of the cross-boundary requirement of industrial planning, administrative organization integration, and public policy support. It has been more than four years since the establishment of the STSP Innovation Services Platform with a successful attraction of investment at the amount of approximately 6 billion by 36 enterprises in the biomedical industry (both at Tainan Science Park and Kaohsiung Science Park). The park enterprise, Hung Chung Bio-S. Co., Ltd., successfully developed Taiwan's first dental implant and became the first certified and registered manufacturer of dental implants in Taiwan on July 27, 2010. At present, it has launched relevant advanced products into the market.

From an academic perspective, more time is needed to monitor the successful operation of this platform but the mechanism to link with academic research to promote the transformation of traditional businesses and the influence of the administration organization to facilitate cooperation between enterprises and academia to promote the development of the biomedical device industry has proven to be effective. This is especially true in regard to the challenges and solutions for the above problems involved in the steel making, precision machining, medical, and medical devices industries, which can be used as the important data for future science park planning and industrial consultation. As a result, according to literature review, this study attempts to examine and understand what the Innovation Services Platform did to promote cooperation among academia, industry, and the medical field and lead a successful market entrance from the development perspective of the dental implant as well as challenges and solutions provided by the Innovation Services Platform during the operation process. In addition to the Introduction and literature review, in Section 3, we address the market state of the dental implant, technology required for market entrance, as well as market barriers in Taiwan. Section 4 explores the process, challenges, and services provided by the Innovation Services Platform for Taiwanese producers to develop a dental implant on their own. In Section 5, based on the above research results, this study concludes the important mechanism as well as points of planning for science parks in Taiwan to operate the Innovation Services Platform; Section 6 includes the conclusion and suggestions proposed by this study.

2. Literature Review

2.1 The concept of the platform

What managers and researchers refer to as "platforms" exist in a variety of industries, especially in high-tech businesses driven by information technology such as Google or Intel. It builds hardware and software products as well as applications, and provides a variety of services, from computers, cell phones, to consumer electronics devices that in one form or another serve as industry platforms. All these firms and their partners participate in what we can call platform-based "ecosystem" innovation[1,2] (Moore, 1996; Lansiti and Levien, 2004). Platforms are also often associated with "network effects": that is, the more users who adopt the platform, the more valuable the platform becomes to the owner and to the users because of growing access to the network of users and often a set of complementary innovations. As we will discuss later, there are increasing incentives for more firms and users to adopt the platform and join the ecosystem as more users and complementors join.

Gawer and Cusumano (2013)[3] compared existing platforms and categorized them into internal and external ones. Internal (company or product) platforms are a set of assets organized in a common structure from which a company can efficiently develop and produce a stream of derivative products while external (industry) platforms such as products, services or technologies are similar to the former but provide the foundation upon which outside firms (organized as a 'business ecosystem') can develop their own complementary products, technologies, or services[4,5] (Gawer and Cusumano, 2002; Gawer, 2009).

2.2 The concept of a business ecosystem

According to Moore1 (1996) the business ecosystem is made up of customers, market intermediaries, companies selling complementary products, suppliers, and the company itself, which can be thought of as the primary species of the ecosystem. Therefore, the business ecosystem is a field of economic actors whose individual business activities are anchored around a platform.

Within a business ecosystem, the activity of a firm relies on a mesh of relationships characterized by varying degrees of intensity with other partner firms that take a more or less significant part in the innovation process. However, a company may be in a central position because of the business potential it creates for other companies. Business relationships give access to knowledge, technologies, and innovation potential, which make it an attractive partner. Within this framework, the networks represent the foundation on which relationships between firms are organized. Lansiti and Levien2 (2004) distinguish three types of actors within a business ecosystem:

- **The Dominators:**

One can distinguish between the "physical dominator", whose role consists in dominating all of its ecosystem's niches via integration strategies that enable it to control the maximum number of nodes within its network, and thereby capture the value created for its own benefit. On the other hand, there is a "value dominator" or "hub landlord" whose role is to extract the maximum value from the network without trying to dominate it. In both instances, the objective pursued is to extract the maximum value without redistributing it to other actors. The resulting effect is usually a

[1] Moore, J.F. (1996). The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems. John Wiley & Sons.

[2] Lansiti, M. and Levien, R. (2004) The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability, Harvard Business School Press.

[3] Gawer A, Cusumano MA, 2013, Industry Platforms and Ecosystem Innovation, Journal of Product Innovation Management, forthcoming.

[4] Gawer, A. and M.A. Cusumano. 2002. Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation, Boston, MA, US: Harvard Business School Press.

[5] Greenstein, S. 2009. 'Open platform development and the commercial Internet', in Gawer, A. (ed.), Platforms, Markets and Innovation, Cheltenham, UK and Northampton, MA, US: Edward Elgar, pp. 219-248.

weakening of the business ecosystem.

- **Keystones:**

This type of actor plays a significant role in both the creation and the redistribution of value created within the network. Contrary to a "dominator", it does not try to control the whole network and its actors, but tries to position itself on a few nodes and assume leadership. The keystones often resort to platform strategies which give them the opportunity to take advantage of the other network actors' contributions by facilitating access to some resources. They usually adopt a "win-win" attitude vis-à-vis the other members of their ecosystem.

- **Niche players:**

There are many such actors, small in size and pursuing a specialization strategy in order to differentiate themselves from the others. They account for a large part of the value created within the ecosystem. The resources they access via the platform made available to them by the keystone give them an opportunity to develop new products or services. Indeed, they maintain very close relationships with the keystone, by actively contributing to the platform's evolution and the dynamics of the ecosystem.

2.3 Innovation ecosystems

As shown in business literature, existing platforms consist of a dominator (in addition to the internal platforms of large scale enterprises) and their business ecosystems are based on the cores of products, services, and technologies. Each member plays both the roles of keystones and niche players. It is worth noting that these business ecosystems do not focus on their geographical locations and there is no role for public or semi-public sectors. In fact, unlike countries in the US and Europe, Asian countries, especially Taiwan, rely on production systems based on small and medium enterprises rather than those of big ones. As a result, industrial and technology upgrading require cooperation between public and private sectors.

If a business ecosystem would like to expand similarly to one in the science parks, the relationship between innovation and the business ecosystem needs to be discussed. Innovative models for enhanced linkages and collaborations can enrich a business ecosystem so that more ideas can surface, more job-creating enterprises can be developed, more companies can find skills and innovation, and more enterprises can increase their capabilities to grow and compete in global markets. Therefore, the term "Innovation ecosystems" can be explained with successful examples of agglomeration whether in geographic, economic, industrial or entrepreneurial terms. In Schumpeter's words, innovation ecosystems are primarily about successful innovative regions (Silicon Valley), or new industries (cloud computing) and entrepreneurs and investors from all over the world jump on the bandwagon of these successes. In short, the STSP and its Innovation Services Platforms are integrated into an "innovation ecosystem" with an Innovation Services Platforms that focuses on the integration of innovation and technology as well as the operation of business model. Innovation ecosystems are based on a business ecosystem and the operation of the business ecosystem is driven by the operation. This study, thus, examines the composite elements of innovation ecosystems as well as the composition structure of Innovation Services Platforms in order to explore the cooperative mechanism between enterprises and academic institutions.

3. An Overview of Southern Taiwan Science Parks and the Medical Device Industry

The Southern Taiwan Science Parks (STSP) as shown in Figure 1 includes the Tainan Science Park and the Kaohsiung Science Park. The Tainan Science Park is situated between the Xinshi, Shanhua and Anding Districts of Tainan City with a total area of 1,043 hectares. The Kaohsiung Science Park is situated between the Luzhu, Gangshan and Yongan District of Kaohsiung City with a total area of 570 hectares. The Tainan Science Park (TSP) was established in 1997 and the Kaohsiung Science Park (KSP) is established in 2003 as the second site managed by Southern Taiwan Sciecne Park Bureau (STSPB). The distance between the KSP and TSP is about twenty kilometers. There have been ideas of utilizing KSP as a spill-over site for the fast expanding TFT-LCD industry in the TSP several years ago, however, stronger calls from both local communities and the STSPB motivated the KSP to construct core industries of its own, preferably, new industries that may have closer relationships with existing industries and may act as a catalyst to transform the local economy. The Medical Device (MD) industry was chosen due to the trend for upgrading for three main reasons.

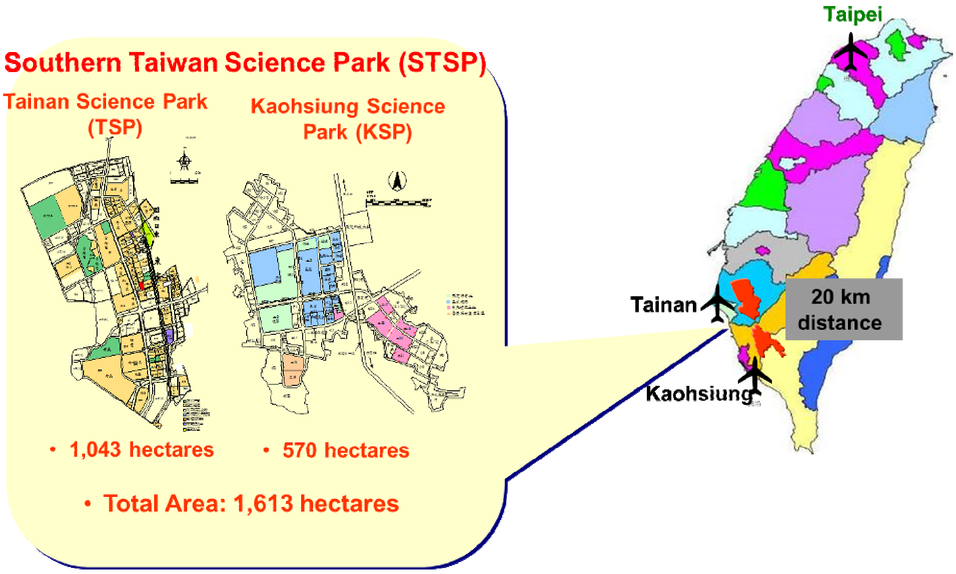


Figure 1: The Location of the TSP and KSP in Taiwan

- First, the MD industry is widely recognized as having a great potential in the future, because of the increase in the global ageing population as well as the rising awareness of the value of health. Different research studies have estimated that the global market for medical devices was approximately 300 billion US dollar per year between 2013 and 2018, with an annual growth rate between 6-9%.
- Second, before the establishment of the KSP, the southern region of Taiwan was famous for its comprehensive steel and chemical clusters. Kaohsiung was a major steel and precision machining industrial center in Taiwan. With a variety of materials and the convenience of the biggest harbor of Taiwan, metal works and precision machinery SMEs have clustered in Kaohsiung and southern Taiwan, and are still a significant industrial sector in the early 21st century (Yen and Kung, 2008)[6]. Yet, with rising industrial competition from China and ASEAN countries, many of these SMEs have to find new methods of production or providing higher value-added and more sophisticated products if they want to compete instead of moving to lower cost countries. Therefore, the MD industry has the opportunity to combine the latest in technology from different fields such as metal, precise machining, chemical, and plastic industries that have high reputations in the manufacturing sector.
- Third, the STSP is in an excellent geographical location surrounded by abundant research resources including four teaching hospitals and a medical center, namely Chung-Ho Memorial Hospital, E-DA Hospital, National Cheng

[6] Yen, Y.-C. and Kung, S.-F., 2008, 'An Empirical Study of Identifying Regional Cluster in Southern Taiwan', Journal of City and Planning, 35 (1): 51-78. (in Chinese).

Kung University Hospital and Chi Mei Hospital, ten public and private universities or colleges, such as National Cheng Kung University, Kaohsiung Medical University, and a non-profit research institute, Metal Industries Research and Development Centre (MIRDC). Besides, there are two industrial parks nearby to formulate a complete supply chain supporting Southern Taiwan Science Park. Therefore, it is considered to be a quite suitable base to help companies in the medical device industry.

In fact, the MD industry is a branch of the biotechnology industry by definition. Since the Taiwanese government has identified the biotechnology industry as a star industry for the 21st century, a great deal of resources has been allocated to strengthen the competitiveness of Taiwan's biotechnology industry as well as medical device industry. The MD industry in Taiwan has been developing for over forty years and the annual quantity of many products have entered the top three of the world ranking, such as the electric scooter, ear thermometer, electronic sphygmomanometer, etc. Currently there are 705 medical device manufacturers in Taiwan (Biotechnology Industry in Taiwan, 2013)[7]. The advantages of the medical industry in Taiwan include comprehensive laws and regulations addressing medical devices, superior medical techniques and hospital quality, excellent management professionals and logistics capabilities, and a high technology base in fields such as ICT, advanced materials, precision processing, mold and die casting. These facts indicate that the medical device industry in Taiwan has quite a sound industrial basis and is globally competitive. Taiwan is, therefore, very suitable to develop the medical devices industry (Chen et al., 2010)[8].

After making an assessment according to the geographical strengths, regional industry system characteristics and national technology policy, the STSPB came to a consensus that the medical device industry is an appropriate industry to develop in the Southern Taiwan Science Park. An idea of a "Medical Device Industrial Cluster" thus emerged. In another feasibility study, the STSPB decided to initiate the Southern Taiwan Bio-Medical Biomedical Devices Cluster Project.

4. The Structure and Service Platform of the "Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project"

From 2009, the "Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project" was promoted by the Southern Taiwan Sciecne Park Bureau and executed by the Metal Industries Research & Development Centre. The structure of the project is shown in Figure 2. The proposed areas of this project include dental instrument systems, orthopedics instruments, cosmetic surgery equipment or instruments, medical alloys, and other sub-areas such as developing technology, training talents, and building a platform for research and development cooperation among potential bio-medical instrument producers. It aims to stimulate to the development of a national bio-medical instrument industry cluster, inspire firms in the industry to be proactive in their research and develop in order to obtain necessary technology, and integrate relevant academic power and establish a platform for training professionals and relaying expertise among members of the bio-medical instrument industry; furthermore, to promote national competency, to construct an ideal and superior environment for academic research, and to integrate the national research and development force toward the required technology for training hi-tech professionals and promoting expertise in order to develop a thriving industry cluster.

[7] Industrial Development Bureau, Ministry of Economic Affairs, 2013, 'Biotechnology Industry in Taiwan'. (in Chinese).

[8] C.-W. Chen, S.-F. Kung, Y.-C. Yen, and B.-W. Huang, 2010, 'The Policy Making Process of the Kaohsiung Medical Device Special Zone in Southern Taiwan Science Park', IASP-ASPA Joint Conference.

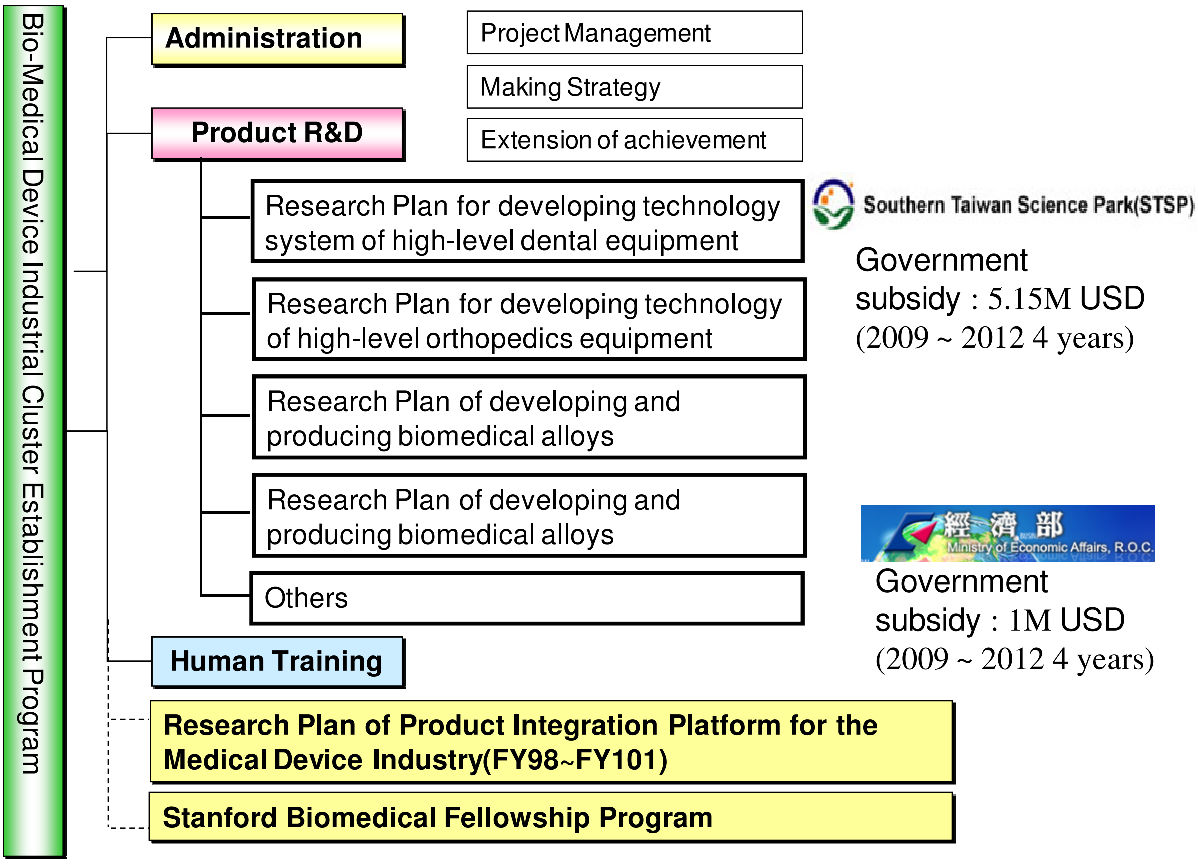


Figure 2: The structure of "Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project"

One of the goals of this project includes upgrading and transforming the industry in Taiwan. This project is a method for members of the industry to tenant in the STSP more easily as the industry may be able to obtain financial support from the STSPB and technical and professional services from the MIRDC. The STSPB provides a subsidy for the industry to do research and development on medical device products. It could help the industry to upgrade products or transform traditional industrial company into a medical device industrial company quickly by obtaining financial support from the STSPB. Moreover, the STSPB is not only the sponsor but also a consultant. Both the STSPB and MIRDC help park enterprises with international marketing services such as providing a national pavilion at famous exhibitions as well as medical device regulation consulting services.

5. Case Study

5.1 About the case

Hung Chung, in the past, specialized in screw tooling devices. Due to the policy encouragement to actively promote the development of the medical device industry and subsidies granted by the Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project, Hung Chung has successfully transformed itself into Taiwan's first Class three implantable medical device manufacturers. At its current stage, it is focused on the design, R&D, and manufacturing of dental implants and relevant medical devices with advanced precision machinery and coating treatment technology. In terms of hardware, Hung Chung is equipped with a Class 1000 Clean Room, an integrated cleaning and packing devices equivalent to the medical standards, and high quality laboratory equipment such as a fatigue testing machine, cupping machine, field emission scanning electron microscope, nano lithographic machine, and atomic force microscope. Hung Chung has also been present at the Incubation Center of Taipei Medical University and with the consultation and assistance from the Research Center for Biomedical Implants and Microsurgery Devices, Hung Chung has been widely recognized for its high quality. It cooperates with National Kaohsiung University of Applied Science on material mechanics and engineering design. From screw tooling molds to dental implant, the products are not only a result of cooperating with the STSPB, firm, universities, hospitals, and public research institutes but also the process to understand and implement innovative concepts to product launch and marketing, the key to duplicating and applying these lessons to future university-industry cooperation. The main elements are described and analyzed below:

5.2 Milestone

Hung Chun Toolings Co., Ltd. was founded in May 1991, the initial staff of about 10 people, on turnover of NT only 500,000. In 2006 began the transition to the biomedical field. HC Bio-S has devoted into developing dental implant system ever since its establishment. With the full support from Southern Taiwan Sciecne Park Bureau in developing biotechnology medical device cluster of the Kaohsiung Science Park, the application for moving into the Kaohsiung Science Park in May, 2008 was approved. The aids from Science Park and the various subsidies allowed HC Bio-S to expand the production on this particular high end medical device. In order to enhance the production level, HC Bio-S implemented GMP and ISO 13485 into quality management for medical device system to build professional factory mainly in developing, designing, and manufacturing dental implant in the early establishment.

2006

June Team was assembled for evaluating marketing and technology development

August Market and equipment in America expedition

October Market and equipment in Europe expedition

December With devotion in developing application nano material technique on biomedical implants and related products, office and lab were established at Taipei Medical University Innovation Incubation Center(Technology matching service platform, Clinical information platform)

2007

October Application for residing in the Southern Science Park and implementing GMP and ISO 13485 for dental implant manufacturer (Product accreditation platform)

Figure 3: The interior and exterior of Hung Chun's standard factory in Kaohsiung Science Park.

2008

October Factory was completed with class 1000 clean room and was incorporated as part of the manufacturing

October Obtained subsidy provided by Southern Taiwan Science Park for Innovation Research and Development with Collaboration between Industry and School

2009

July Qualified by GMP for medical device manufacture factory

September Obtained Biotechnology medical devise zone development subsidies for three years provided by Southern Taiwan Science Park

December Successfully developed innovated hydrophilic dental implant with patent surface treatment technique named SLAffinity®.

2010

March Dental implant system with massive production which is named Ti-One 101 dental implant system"

August The first company to obtain Class three manufacturers certification for dental implant system in Taiwan

December Signed Contracts with distributor Cosm-Lion Co., Ltd. for Taiwan (Product promotion platform)

2011

January Ti-One®101 dental implant system launched

May Obtained Silver award in Moscow International Salon of inventions and innovation technologies «Archimedes» for Ti-One®101 dental implant system

June Obtained Gold award in Inventeco International Invention Show in Italy for Ti-One®101 dental implant system

Obtained 8th Taiwan National Innovation Award

October HC Bio-S was considered as Innovative Biotechnology Medicine Company by Ministry of Economic Affairs

November Obtained CE 0123 and ISO 13485 Certifications

2012

July Obtained U.S.A. FDA certification

August Signed distributor contract with A-Plus shine Bio-Med Co., Ltd. for Taiwan (Product promotion platform)

2013

February Coland invested in Hung Chun to access to China dental market

March Obtained Annual Taiwan Golden Root Awards for Ti-One®101 dental implant system

2014

Built the new factory

Figure 4*: The blueprint of the new factory of Hung Chun Bio-S Co., Ltd.*

Figure 5: Milestone of Hung Chun Bio-S Co., Ltd.

5.3 STSPB played an important role as the "dominator" in the construction of the innovation ecosystem

Open innovation has been a prevalent innovation model in Europe and the US. It effectively connects concepts and products via open platforms. The key element of the platform operation is the dominator. As shown in international cases, most successful models are those platforms dominated by big enterprises such as Apple and Intel since they control technology as well as market scales and channels. Manufacturing is not a core skill, and therefore, manufacturing has been outsourced oversea. Unlike Europe and the US, innovation models are mostly initiated by small and medium enterprises (SMEs). For example, in Taiwan, 97% of its enterprises are SMEs and the platforms are hardly dominated by business owners. Even the most well-known A-team of Giant was led by the public sector at its initial stage and was later transferred to a company that would operate within the business ecosystem.

The medical device industry requires very complicated industrial technology and product screening and barriers of market entry are relatively tough. It was not easy for Taiwanese enterprises to enter the market as a late entrant. But along with improvements in the economic environment as well as the expectation of medical quality and treatment effectiveness, various types of advanced technologies have been applied to the development of medical devices. Generally, the existing market of medical devices can be easily replaced with equivalent products with better quality. Therefore, the medical device industry needs to increase expenditures on R&D more than traditional manufacturers to speed up product launches in order to survive. It is a technology intensive and labor less intensive industry and the key to success is continuous innovative R&D and meeting clinical demands.

Since medical devices are essential for human life, stricter standards are imposed on safety and effectiveness. Hence, each country government has regulated relevant management rules and regulations. Before coming to their markets, strict accreditations are required. In Europe and the US, rules and regulations require immediate recalls if accidents occur and statistical reports have to be provided. But the stricter standards in safety, reliability, and effectiveness often result in high costs for the initial operation of small firms and again, small firms are likely to find it difficult to survive as well as enter the market.

In the end, the medical device industry involves professional medical behaviors and thus, the hospital system plays an influential role. The hospital system has been known as a professional and closed market and sales made to hospitals are done different from channels in other industries. Promotion methods need also be applied differently. Overall, industrial pulls tie to research, rules and regulations, and marketing.

Due to the above factors, even though Hung Chung had the mold making technology, it could not build a platform on its own that could integrate different organizations and resources. Relatively, the drive to transform was limited. The STSPB, as a governmental agency, again, unlike those managed by the private sector in Europe and the US, needed to take charge of the administration of the science parks and shoulder the responsibility of promoting industrial upgrading and local development. From the future prospect of investment invitation to the science parks, the SPSPA through the integration of central and local governmental resources is able to act as the platform dominator for construction. It was also because of the participation of this governmental agency that relevant enterprises felt more assured and were more willing to invest in resources for product transformation and technology upgrades. The importance of governmental participation in the innovation models can be observed in Taiwan and other Asian countries by reviewing the differences in intervention models and involvement levels.

5.4 The MIRDC played an important role in linking knowledge creation to enterprise creation

The ideas-to-markets chain starts with centers of knowledge creation. R&D increasingly depends on the collaboration between firms and universities. But the interests of the parties are not always well-aligned. University technology transfer offices, which have been growing in number over the past 20 years, are often more interested in maximizing their own revenue rather than maximizing venture formation. Unlike Europe and the US, Taiwan's public research institutes play an important role in closing the gap of knowledge creation among enterprises.

Although the government is willing to create the platform there are still some difficulties encountered by the government or academic institutions as they try to integrate resources alone. Unique national research institutions in Asia play a key role. From the ITRI in the past to the current MIRDC, national public research institutions do not only work with schools for technology cooperation and R&D but also to establish complete industrial chains via spin-offs. They now play a more active role in closing the gap between industry and academia and to help industries break through technology barriers. They themselves do not need to possess or research and develop complete technology and instead, through screening market information, they work with schools on R&D. They are also proactive third-party advisors of enterprises that help the firms to look for schools to solve issues related to production technology and marketing.

Hung Chung, for example, experienced a technology gap between the manufacturing of screws and artificial tooth roots and it needed the assistance of those in the medical field and in research institutions. The medical professionals analyzed and compared clinical data, surgery device designs, and advised on the pros and cons of existing implants. It also provided sufficient clinical information during product launches to allow the industry to give immediate feedback for the improvement of implants and machines. Academia drove the rapid growth of industrial technology in terms of processing and surface treatment, building the solid foundation of the Kaohsiung Science Park as the home of the dental industrial cluster. In Stage II, academia, research institutions, and the medical field provided tests, accreditations, and planning services during product launches. Products were launched quicker than was possible before their help. In Stage III, marketing was assisted through the coordination of cluster products and integration of industry exhibition mechanisms. It was based on the B to C concept on the interactive platform to cooperate with the medical circle. By participating in professional dental annual galas and exhibitions, the B to B product marketing concept became the focus.

5.5 Introduction of technology and resources via innovative service platforms: the MIRDC as the gatekeeper for defining problems from product conceptualization to marketing and to re-distribute technology and resource investment.

In Taiwan, the majority of enterprises in the medical device industry are SMEs that are limited by manpower, technology, equipment, and capital. Hence, they can only concentrate their R&D strength on products, and they even have difficulties with completing simulations, tests, and test production at the R&D stage. There is a need to rely on professional knowledge provided by the R&D service platform to speed up innovation and transformation as well as to achieve the goal of maximizing industrial value. For this purpose, in the sub-projects of industrial technology R&D platforms, the following platforms have been developed:

1. Technology matching service platform

The purpose of this platform is to integrate the energy of relevant domestic and international research institutions and schools on medical device studies to form a complete service network and to establish a single window for the provision of quick access to R&D resources by tenant enterprises in order to provide quick product development.

2. Clinical information platform

The purpose of this project is to satisfy clinical information needs during the medical device product development process. Items addressed include (1) to improve clinic information exchange during the R&D process; (2) formation of professional teams and R&D discussions; and (3) pilot consultation and evaluation of clinical experiments. Through the operation of these three project items, the goal to provide the industry with clinical clinic information can be achieved.

3. Product launch service platform：

The medical device industry has high market barriers, but after products are launched into the market, due to the requirements for accreditation and limits on promotion channels, they have a relatively long product life cycle and impressive profits compared to other industries. It is planned that with this sub-project, resources can be integrated before product launches to reduce costs and improve efficiency and service levels. According to this sub-project, two platforms are constructed for product accreditation and promotion:

(1) Product accreditation platform:

Ethylene Oxide (EtO) sterilization system, high-temperature sterilization equipment, and relevant sterilization test equipment are required to build a GLP sterilization laboratory (including sterilization system and a packing material aging and fatigue test lab). By working with existing vendors to provide sterilization services and training for practical operators, we help enterprises to improve sterilization effectiveness and manufacturing processes. Additionally, an investigation on the gaps in the domestic sterilization industry has been conducted to develop a new sterilization method to replace the traditional one, to assist with technology updating for the sterilization industry, and to improve domestic medical quality.

The product accreditation service platform will be built and the Metal Industries Research & Development Centre will take charge of the operation. After the Centre becomes the accreditation center for medical device products, the professional skills for accreditation services will be cultivated. Meanwhile, the resources of Taiwan's relevant private accreditation organizations can be integrated for more effective accreditation compliance. Cooperation with international and EU notified bodies can also be facilitated for the mutual acceptance of test reports to save the costs and time of enterprises that are spent on identical tests and reduce the time needed for product launches.

(2) Product promotion platform

The purpose of this project is to construct a promotion platform that helps to boost the overall image of Taiwan's medical device industry. Through the establishment of the National Image Pavilion of High-End Products, oversea technology matching seminars, and oversea expansion, the visibility of Taiwan's medical device products has been enhanced. Furthermore, a brand mechanism shall be jointly created to achieve strategic alliances and joint Internet promotions among domestic brand leaders and medical device makers. At the same time, the cluster exhibition is designated in the medical device area to boost product visibility and increase matching opportunities for agents.

6. Conclusion

With the development experience of the medical device industry, Taiwan is successfully creating a series of innovative service platforms that will not be easy to duplicate in other countries. However, there are several important mechanisms in this study that can serve as a reference for other countries.

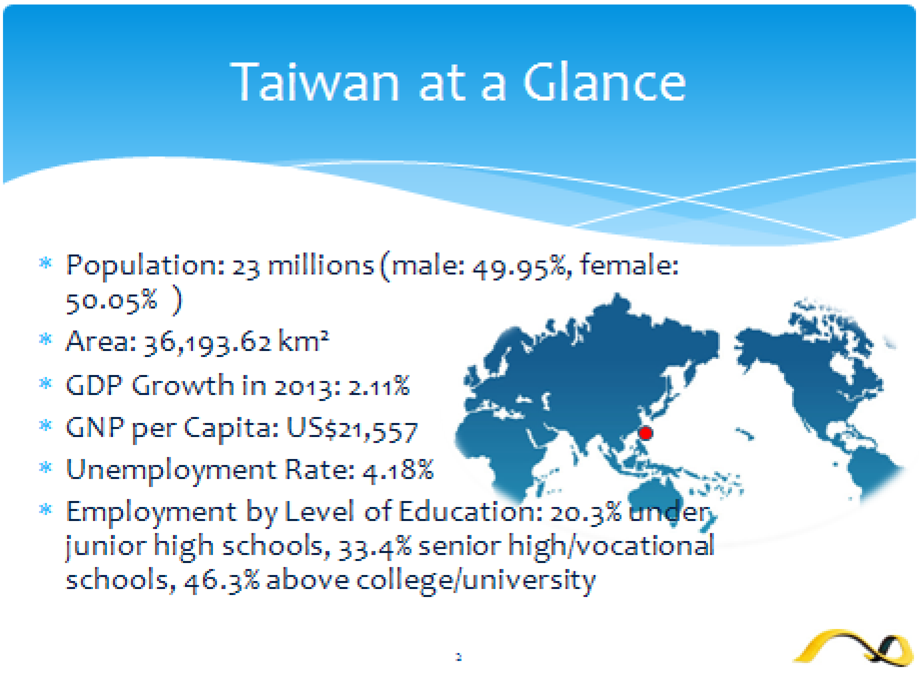
First, countries in the initial stages of industrial development can give enterprises more confidence by constructing platforms and operating mechanisms. Then after entering the development stage, platforms should be given to the private sector for free operation. As a result, this innovative platform in Taiwan is considered a task oriented model and only when its operation is transferred to the private sector will sustainability will be achieved.

Second, several studies around the world have focused on the innovations of Taiwan's public research institutions. In the past, the dominator used to be enterprises derived from public research institutions and there had been fewer barriers to communications between the industry, academia, and research institutions. The system in operation at the time was not as complicated as it is now. Hence, facing the current complicated business ecosystem, public research institutions need to play a role in linking knowledge creation and business creation. There is, thus, a need for Taiwan to establish public research institutions with different industrial attributes. If a country wants to develop its newly emerging industries based on SMEs, it can consider the feasibility to reduce losses in transaction costs.

Reference

1. Moore, J.F. (1996). The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems. John Wiley & Sons.
2. Lansiti, M. and Levien, R. (2004) The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability, Harvard Business School Press.
3. Gawer A, Cusumano MA, 2013, Industry Platforms and Ecosystem Innovation, Journal of Product Innovation Management, forthcoming.
4. Gawer, A. and M.A. Cusumano. 2002. *Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation*, Boston, MA, US: Harvard Business School Press.
5. Greenstein, S. 2009. 'Open platform development and the commercial Internet', in Gawer, A. (ed.), *Platforms, Markets and Innovation*, Cheltenham, UK and Northampton, MA, US: Edward Elgar, pp. 219-248.
6. Yen, Y.-C. and Kung, S.-F., 2008, 'An Empirical Study of Identifying Regional Cluster in Southern Taiwan', Journal of City and Planning, 35 (1): 51-78. (in Chinese).
7. Industrial Development Bureau, Ministry of Economic Affairs, 2013, 'Biotechnology Industry in Taiwan'. (in Chinese).
8. C.-W. Chen, S.-F. Kung, Y.-C. Yen, and B.-W. Huang, 2010, 'The Policy Making Process of the Kaohsiung Medical Device Special Zone in Southern Taiwan Science Park', IASP-ASPA Joint Conference.

二、2014 IASP 簡報

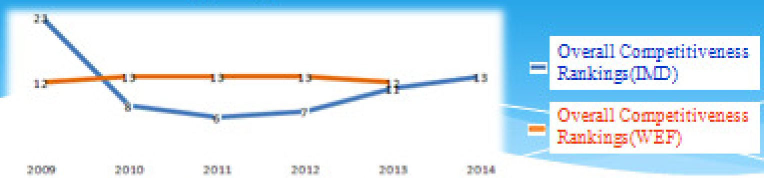


Taiwan Academia System

- No. of Higher Education Institutes (University, College, Junior College): 161
- Graduates from University, College and Junior College: 309,333
- QS World University Rankings 2014/15: 11 universities in top 500 rankings
  - National Taiwan University: 76
  - National Tsing Hua University: 167
  - National Chiao Tung University: 202
  - National Cheng Kung University: 232
- IMD Ranking: 22 in Education

3

Taiwan: Highly Ranked in Global Standings



Technological Infrastructure -IMD (60 countries)	
1st	Hong Kong
2nd	Singapore
3rd	US
4th	Taiwan
5th	Malaysia
6th	Sweden
8th	Korea
17th	Japan
20th	China

Scientific Infrastructure -IMD (60 countries)	
1st	US
2nd	Japan
3rd	Germany
4th	Switzerland
6th	Korea
7th	China
9th	Taiwan
17th	Singapore
26th	Hong Kong

Innovation and sophistication factors -WEF (148 countries)	
1st	Switzerland
2nd	Finland
3rd	Japan
4th	Germany
5th	Sweden
9th	Taiwan
19th	Hong Kong
20th	Korea
34th	China

Source: The World Competitiveness Yearbook 2014 (IMD), May 2014 ; The Global Competitiveness Report 2013-2014 (WEF), September 2013.

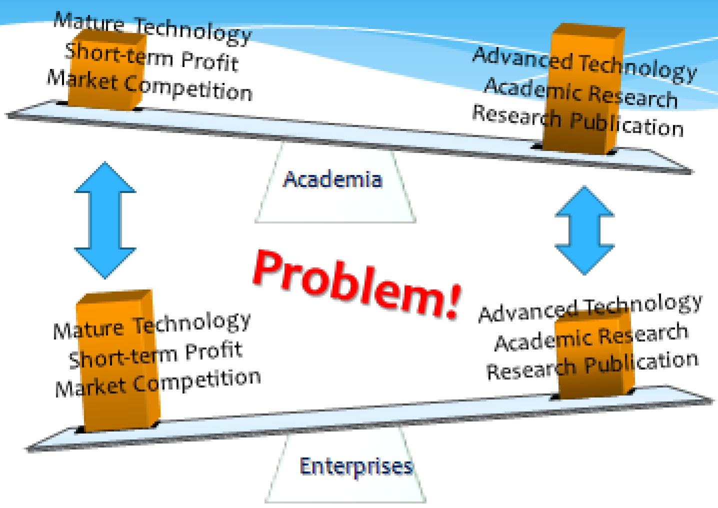
4

Today's Presentation

I. Introduction
II. An Overview of STSP
III. The New Style of "One Stop Service"
IV. Case Study
V. Conclusion

5

I. Introduction



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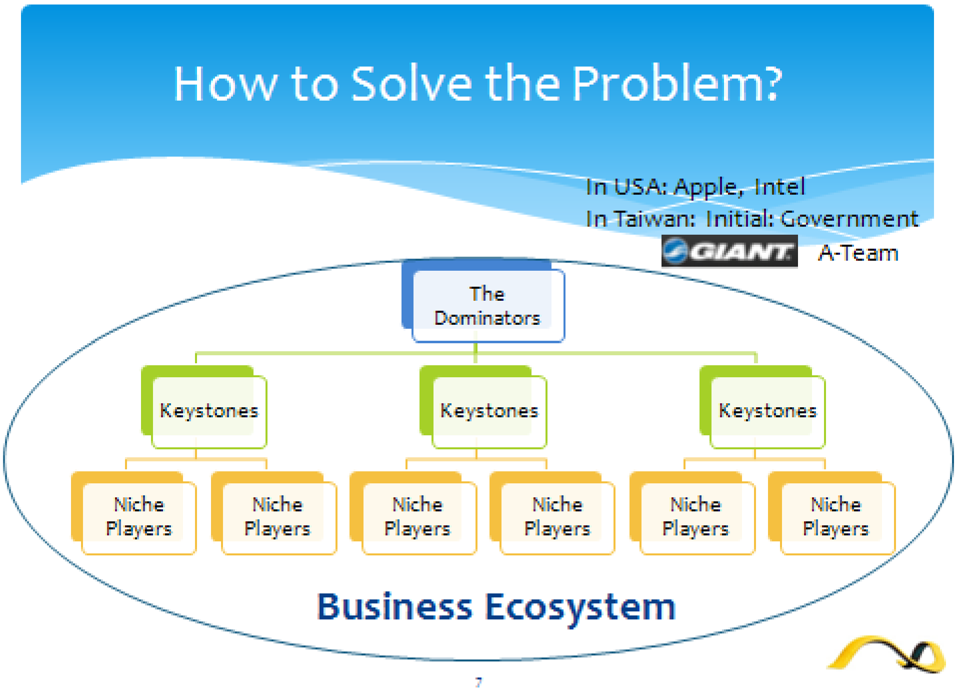
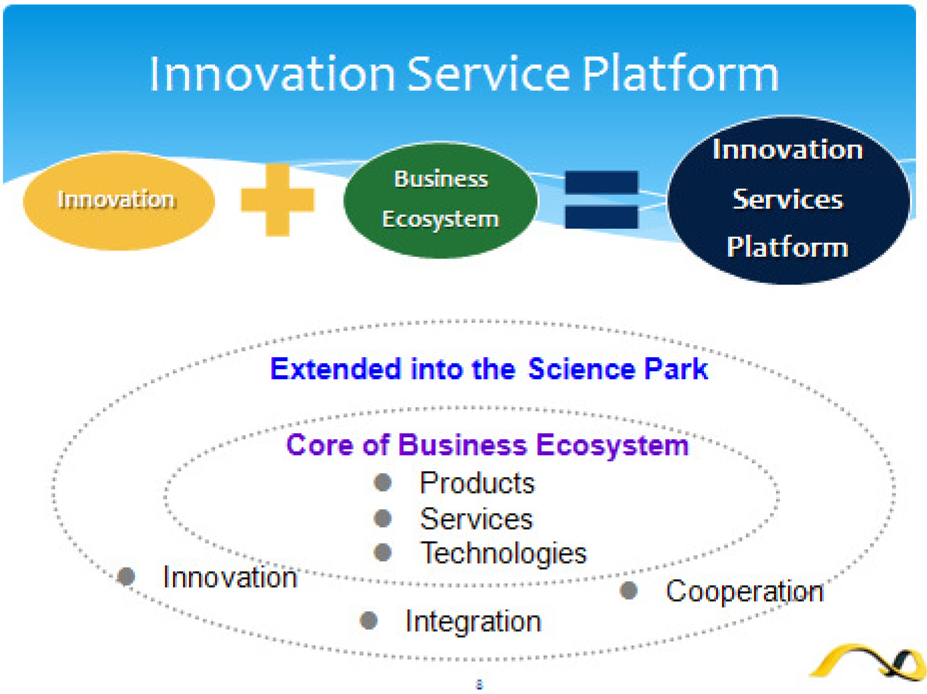
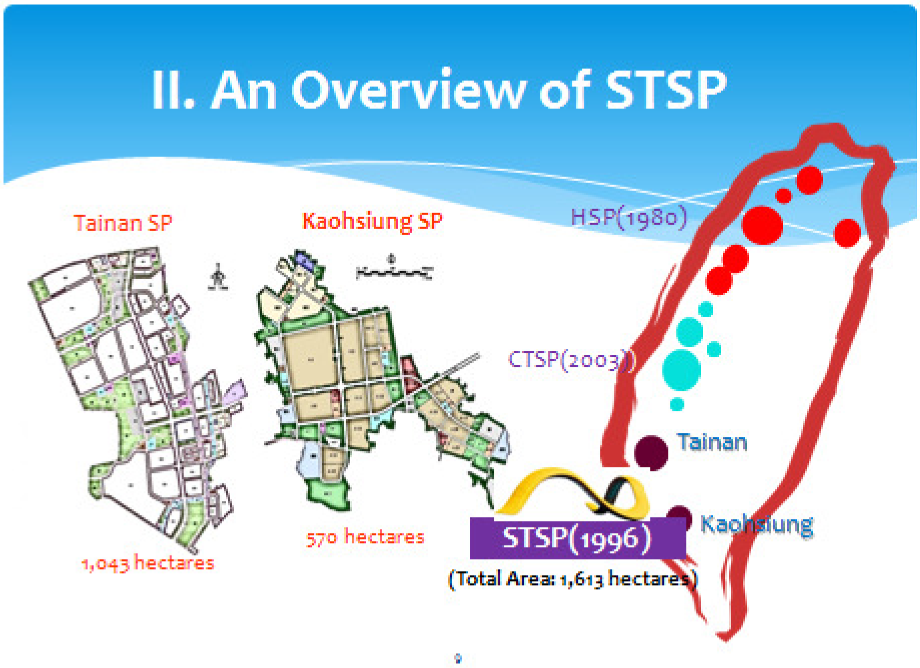
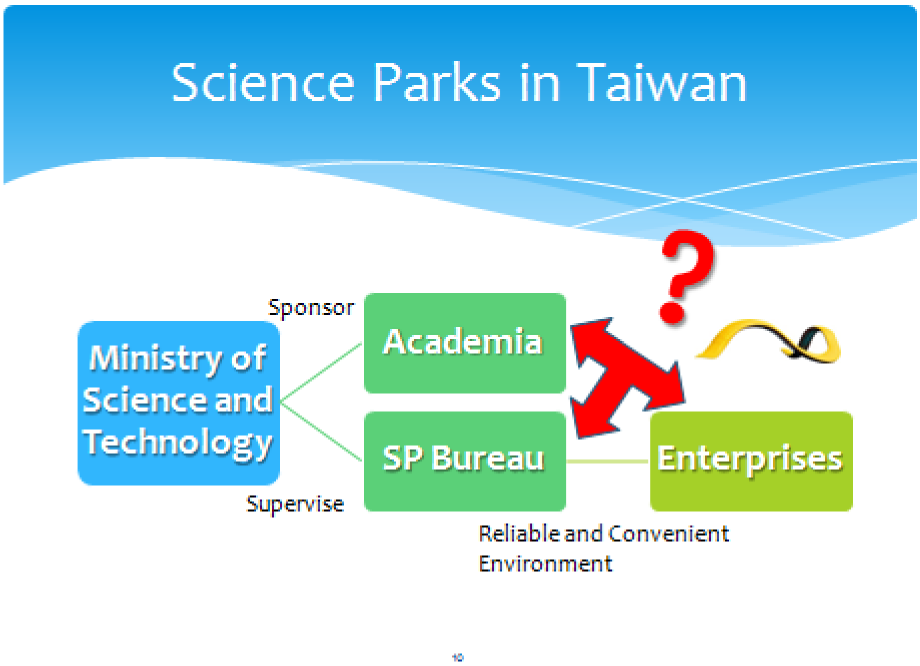
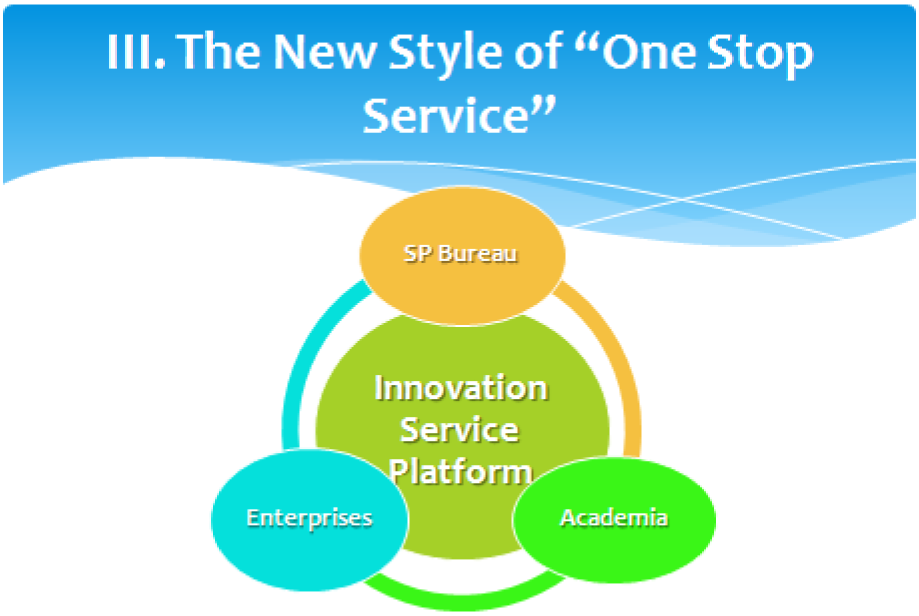
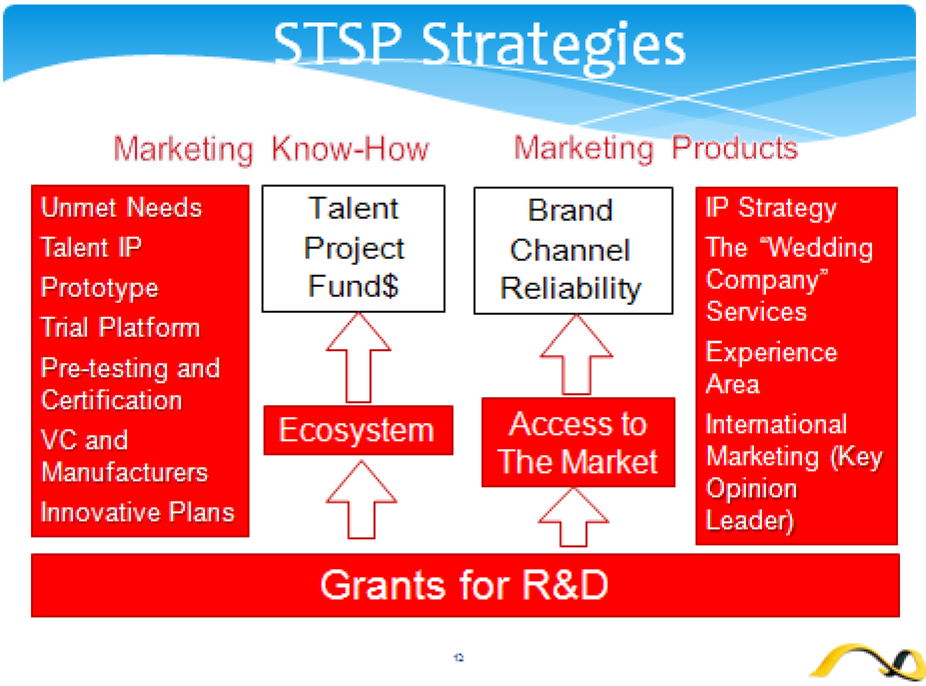

How to Solve the Problem?
In USA: Apple, Intel
In Taiwan: Initial: Government
GIANT A-Team
The Dominators
Keystones
Keystones
Keystones
Niche Players
Niche Players
Niche Players
Niche Players
Niche Players
Niche Players
Business Ecosystem
7


Innovation Service Platform
Innovation
Business Ecosystem
Innovation Services Platform
Extended into the Science Park
Core of Business Ecosystem
Products
Services
Technologies
Innovation
Integration
Cooperation
8


II. An Overview of STSP
Tainan SP
Kaohsiung SP
HSP(1980)
CTSP(2003)
Tainan
Kaohsiung
1,043 hectares
570 hectares
STSP(1996)
(Total Area: 1,613 hectares)
9


Science Parks in Taiwan
Sponsor
Ministry of Science and Technology
Academia
SP Bureau
Enterprises
Supervise
Reliable and Convenient Environment
10

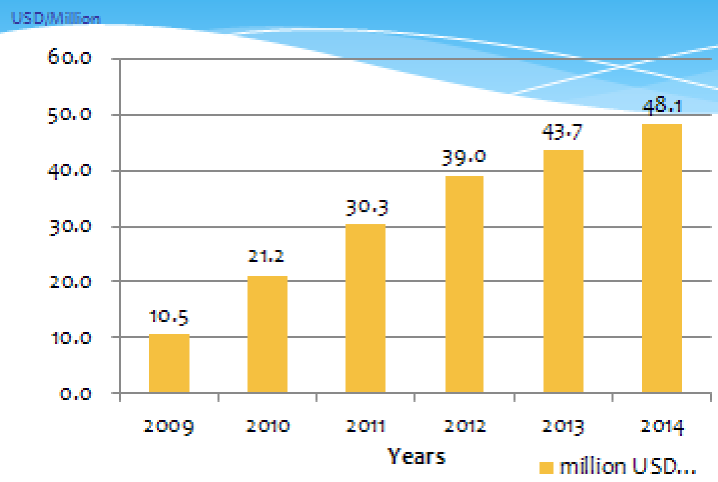

III. The New Style of "One Stop Service"
SP Bureau
Innovation Service Platform
Enterprises
Academia


STSP Strategies
Marketing Know-How
Marketing Products
Unmet Needs
Talent IP
Prototype
Trial Platform
Pre-testing and Certification
VC and Manufacturers
Innovative Plans
Talent Project Fund$
Ecosystem
Brand Channel Reliability
Access to The Market
IP Strategy
The "Wedding Company" Services
Experience Area
International Marketing (Key Opinion Leader)
Grants for R&D


"Wedding" Company Services
Innovation Service Platform
Technology Matching Service Platform
Clinical Information Platform
Product Marketing Platform
Clinical Needs
Basic Research
Prototype Design
Prototype
Verification
Clinical Trial
Pilot Production
Registration
Production
Sale
Post Market Surveillance
13


Resource Links
國家實驗研究院
NDL
MIRDC
NLAC
實驗動物中心
National Labs
Academia
Hospitals
Project Grants
STSP
Others
14

Project Grants



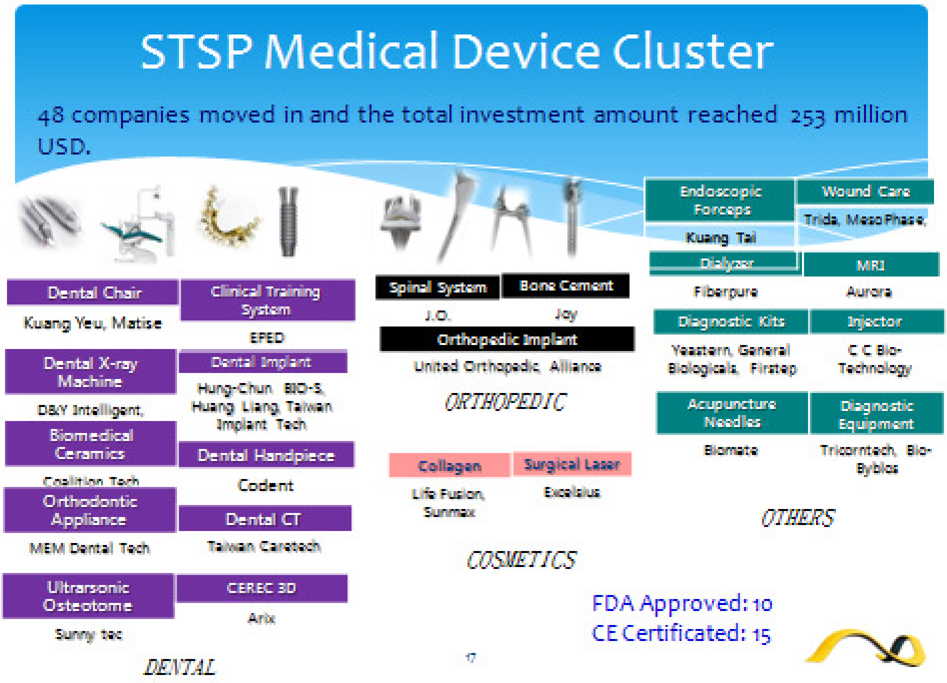
15

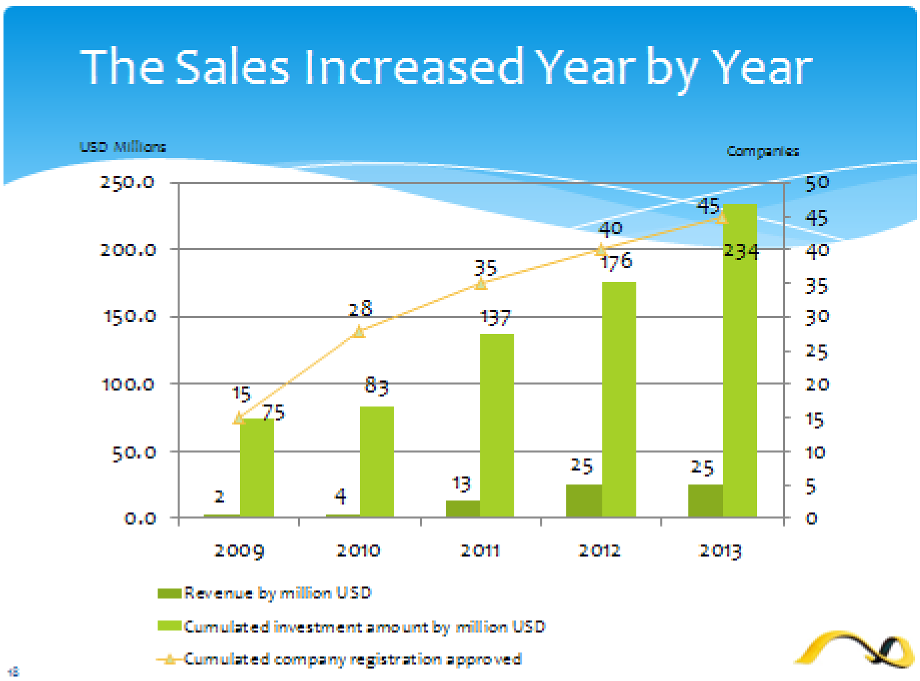
Access to Markets

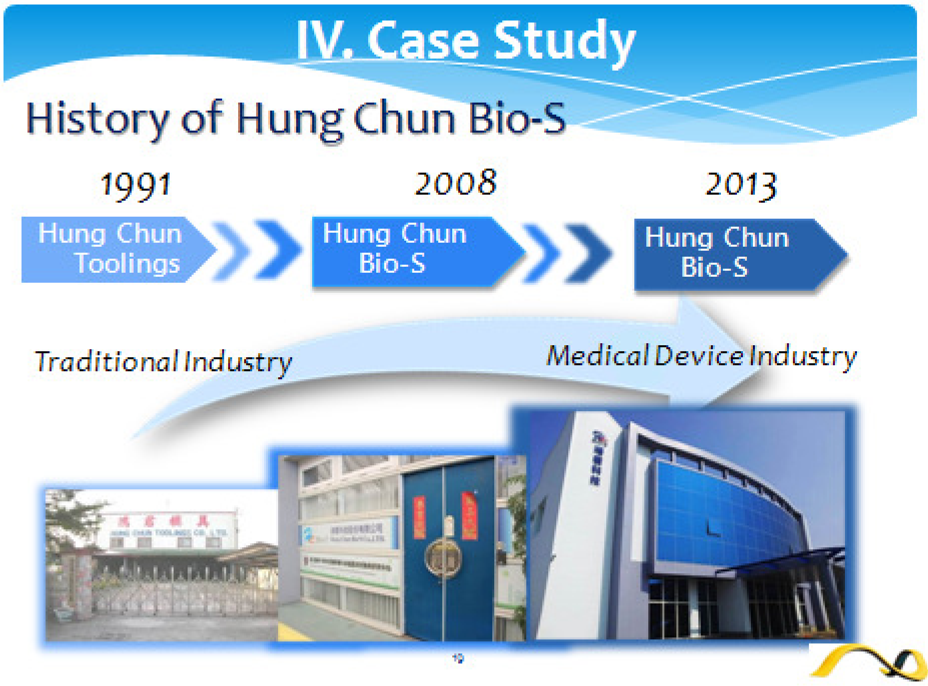
Showroom for one-stop shopping

International Exhibitions

16


STSP Medical Device Cluster
48 companies moved in and the total investment amount reached 253 million USD.
Dental Chair
Kuang Yeu, Matise
Clinical Training System
EPED
Dental X-ray Machine
D&Y Intelligent,
Dental Implant
Hung-Chun BIO-S, Huang Liang, Taiwan Implant Tech
Biomedical Ceramics
Coalition Tech
Dental Handpiece
Codent
Orthodontic Appliance
MEM Dental Tech
Dental CT
Taiwan Caretech
Ultrarsonic Osteotome
Sunny tec
CEREC 3D
Arix
DENTAL
Spinal System
J.O.
Bone Cement
Joy
Orthopedic Implant
United Orthopedic, Alliance
ORTHOPEDIC
Collagen
Life Fusion, Sunmax
Surgical Laser
Excelsius
COSMETICS
Endoscopic Forceps
Kuang Tai
Wound Care
Trida, MesoPhase,
Dialyzer
Fiberpure
MRI
Aurora
Diagnostic Kits
Yeastern, General Biologicals, Firstep
Injector
C C Bio-Technology
Acupuncture Needles
Biomate
Diagnostic Equipment
Tricorntech, Bio-Byblos
OTHERS
FDA Approved: 10
CE Certificated: 15
17


The Sales Increased Year by Year
USD Millions
Companies
250.0
200.0
150.0
100.0
50.0
0.0
50
45
40
35
30
25
20
15
10
5
0
2009
2010
2011
2012
2013
2
75
15
4
83
28
13
137
35
25
176
40
25
234
45
Revenue by million USD
Cumulated investment amount by million USD
Cumulated company registration approved
18


IV. Case Study
History of Hung Chun Bio-S
1991
2008
2013
Hung Chun Toolings
Hung Chun Bio-S
Hung Chun Bio-S
Traditional Industry
Medical Device Industry
19


Service Platforms Help Industrial Upgrading
Product Promotion
Product Accreditation
Service Platforms
High-end Dental Implants
Metal Parts/Molds
Clinical Information
Technology Matching
20

Milestone of Hung Chun Bio-S Co., Ltd.

Technology Matching Service Platform

- Developing application nano material technique on biomedical implants and related products

Clinical Information Platform

- Establishing office and Lab at Taipei Medical University Innovation Incubation Center

Product Accreditation Platform

- Implementing GMP and ISO 13485 for dental implant manufacturer

Product Promotion Platform

- Signed Contracts with distributor Cosm-Lion Co., Ltd.
- Signed distributor contract with A-Plus shine Bio-Med Co., Ltd.

21

These service platforms, which links hospitals, industries, government, as well as academic and research institutes, facilitate transformation of a simple screw to a sophisticated dental implant.

22

V. Conclusion

1. The value of the innovation service platforms should be strengthened.
2. The operation of the innovation service platforms should be task oriented and transferred to private sectors to achieve sustainability.

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Thank You.

Name: Andrea T. J. HSU

Title: The Cooperative Mechanism for the STSP Innovation Services Platform to Link up with Enterprises and Academia

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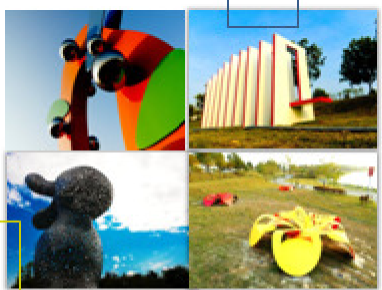
Organization: Southern Taiwan Science Park Bureau, Ministry of Science and Technology



IASP

QATAR SCIENCE & TECHNOLOGY PARK

三、2014 ASPA 論文全文

(一) 綠能低碳

The Platform Establishment Policy to Develop Green Energy Low-carbon Industry Cluster in STSP

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ABSTRACT

This study is an examination of the platform establishment policy to develop a green energy, low-carbon industry cluster in the Southern Taiwan Science Park (STSP). The Southern Taiwan Science Park Bureau, Ministry of Science and Technology has endeavoured to provide a bridging/matching service for universities and tenants in the STSP to facilitate university-industry collaboration in innovation. Our policy aims at establishing a user-friendly platform to make services available to start-ups and high-tech companies which would like to set up operations in the STSP. The services include matching services among industry, universities and research institutes to facilitate the undertaking of cutting-edge clean energy technology and energy-saving, low-carbon product R&D, testing and certification at STSP, as well as the provision of subsidies for innovative, high-value-added researches, and matching services to help potential companies interested in setting up a business within STSP to obtain the funding, human talent, technology and marketing resources

they need. Through these measures, it is anticipated that STSP can be developed into a world-class renewable energy industry cluster and low-carbon community.

KEYWORDS: Southern Taiwan Science Park (STSP); green energy and low carbon; industry cluster

INTRODUCTION

With increased levels of industrialization in human society, the problem of global warming is becoming increasingly severe. In recent years, all regions of the globe have experienced some degree of abnormal climate conditions, which has awoken the international community's attention toward energy conservation and environmental protection. Similarly, the United Nations has also realized the importance of dealing with global environmental protection issues with the same level of urgency as issues concerning economic growth. This is why the United Nations Framework Convention on Climate Change (UNFCC) was proposed—in order to call upon all nations to work toward the mutual goal of a low-carbon economy and a low-carbon society, and require all nations to commit to more aggressive carbon emissions reduction goals. In February of 2009, the United Nations Environment Programme (UNEP) published the "Global Green New Deal"[1], [2] report, recommending that each nation contribute 1% of its GDP (approximately 750 billion USD) to green environment development, assisting green-collar workers in finding jobs, and driving green technology development and events. Areas being advocated include:

(1) Increase the energy efficiency of buildings
(2) Investment in renewable energies (including solar energy, wind energy, geothermal energy, and biomass energy, etc.)
(3) Investment in green transportation and environments (including hydrogen vehicles, high speed railways, and fast metro transit systems, etc.)
(4) Investment in high-quality global ecosystems (including clean water, forests, and soil, etc.) and environments
(5) Investment in sustainable agriculture

UNEP emphasizes that the key to a green economy lies in the introduction of green technology solutions, including clean production processes, pollution prevention, end-of-pipe/monitoring, CO2 handling, and storage, etc., which encompasses technologies, processes, products, services, equipment, organizations, and management, etc., and is a key to the development of a green economy.

When the global financial crisis hit and global economic development was crippled, the world hoped that by developing the green economy in the face of a deep recession and the need to rebuild the economy after the crisis, we would be able to solve the problem of a stagnant economy as well as the problem of global warming at the same time. This would be accomplished through promotion of the Green New Deal and green investments, thereby creating a win-win situation for the environment as well as for the economy. Therefore, in its 2011 "Transit to a Green Economy"[3] research report, the United Nations recommended that each country allocate at least 2% of its GDP to invest in green activities, including in the economic sectors of agriculture, construction, energy, fishery, forestry, manufacturing, tourism, and transportation, which would not only achieve the goal of greenhouse gas emission reduction, but would also create a large number of jobs and reduce poverty. With the United Nations' promotion of the green economy as well as its efforts in driving global green energy and low carbon development, the world has been united with a common goal, with governments all over that world designating green energy as one of their key national development goals.

In the United States, after the Obama Administration took office, it began implementing the Green New Deal ("Green Economy Recovery Plan"). The United States' "Green New Deal" can be further divided into several aspects: energy conservation and increasing efficiency, developing new sources of energy, and responding to climate change, in which the core of the Green New Deal is the development of new energy sources. In its 827 billion USD economic stimulus plan, the United States' new government proposed using 100 billion USD (equivalent to approximately 0.7% of the United States' GDP) over the next two years in its green economy recovery plan. This includes 20 billion USD for clean energy tax incentives, 32 billion USD for upgrading the electrical grid in order to facilitate the use of clean energies, and 16 billion for reducing energy consumption in public buildings. The United States' plan for developing new energy sources includes the development of high-performance batteries, the smart grid, carbon capture and storage, as well as renewable energy sources such as wind energy and solar energy. In its proposed "Green Revitalization Plan," the US government will establish a 150 billion USD "Clean Energy Research and Development Fund" for engaging in development of renewable energy technologies over the next 10 years.

As for the European Union, as early as 2007 year end, the EU announced its technological roadmap and low-carbon technology development investments for its Strategic Energy Technology Plan (SET–Plan), planning in detail the technological development, deployment, research and development, implementation, as well as investments in wind power, solar power, the electrical grid, bio-power, carbon capture and storage (CCS), as well as sustainable nuclear power. A 200 billion Euro (1.5% of the EU's GDP) budget was even passed in November of 2008; this plan included 4 prioritized areas: the general public, commerce, infrastructure and energy, as well as research and innovation. The EU also urges nations to engage in green technology R&D. On March 9, 2009, the EU officially kicked off its overall green economy development plan. According to this plan, the EU will invest 105 billion Euros in the fostering, support, and establishment of the "green economy" by 2013. This plan includes the R&D, application, and promotion of technologies for new energy sources, new materials, and new products. It also includes technical innovation as well as transformation in term of the current industrial economy, as well as innovation of alternative energies and process technologies with the goal of "emissions reduction."

In order to kick-start the development of its green energy and low carbon industries, Taiwan's Executive Yuan will invest 45.4 billion NTD in driving its Flagship Green Energy Plan, which will use Taiwan's IT, semiconductor, flat panel display, electromechanical, metals, and composite materials industries as a starting point for entering the high-potential green energy industry, thereby driving the development of Taiwan's green energy and low carbon industries. It will also allocate 10% of its public constructions budget to developing green facilities and techniques in order to achieve the multiple goals of energy conservation, carbon reduction, stimulating domestic demand, and taking care of local industries. It is estimated that 130 thousand jobs will be created by 2015. In addition, in terms of the development of key industrial technologies, Taiwan has not only engaged in the research and development of key technologies, but has also designated the solar and optoelectronics, LED lighting, wind power, biomass fuel, hydrogen and fuel cell, energy information and communications, as well as electrical vehicle industries as key industries for development, in hopes of transforming Taiwan from an IT kingdom to an ET kingdom. The Ministry of Economic Affairs has introduced the "Green Energy Industry Dawning Project" to develop the low-carbon industry, and has chosen the solar and optoelectronics industry in the area of renewable energies as well as the LED lighting industry in the field of energy conservations as key industries for development, and refer to them as the "Champion Energy and Optoelectronics Industries." According to this project, by 2015 the output of the solar and optoelectronics industry will reach an estimated 450 billion NTD, the LED lighting industry will reach 540 billion NTD, and the overall green energy industry will surpass 1000 billion in size[4].

RESEARCH METHODS

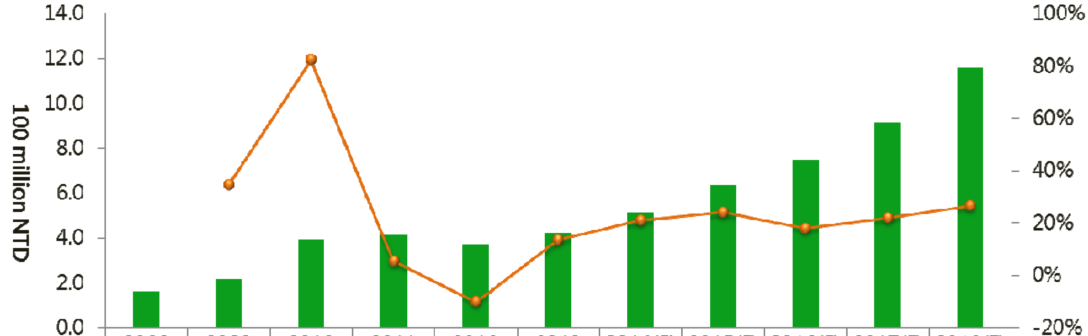
The definition of the term "industry cluster" given by Harvard Business School professor Michael Porter (2001) in his research report will be used in this study[5], [6]. An industrial cluster refers to a group of geographically neighbouring corporations and entities in a certain field that are mutually related and connected through their mutual commonalities as well as complementary properties. The scale of an industry cluster can range from a single city, to a country, and even to a network spanning across neighbouring countries. There are many types of industry clusters, which are determined based on their degree of breadth and width, as well as their level of complexity. However, most industry clusters include final product or service vendors, professional components vendors, spare parts vendors, equipment and service providers, financial institutions, as well as vendors from related industries. In terms of the implementation of Taiwan's industrial strategies, niche industry clusters are developed through the combined efforts of industry, government, and academia in order to achieve global competitiveness. This form of competitiveness lies in between contract manufacturing and innovative R&D of self-owned brands, and represents the type of industry Taiwan can develop in its next phase. In summary, Michael Porter emphasized that the advantages of industries lie in the matching and combined effects of their basic conditions, and that assessments of the effects resulting from changes in the industrial environment should be conducted based on the combined effects of key conditions. Therefore, through analysis and assessment of an area's unique resource conditions and advantages, effective data can be provided for governments to set, execute, and control policies, as well as to plan out relative policies that are most advantageous to industry.

In addition, this study also uses the Economic Strategic Development Model proposed by economist Kenneth R. Andrews[7], [8], which states that strategic analysis includes internal analysis capabilities, which encompasses strength and weakness analyses, as well as assessment of opportunities and threats from the external environment. In corporate management theory, SWOT analysis is a form of strategic planning, and is primarily used in this study to assess the advantages and disadvantages of the Southern Taiwan Science Park (STSP), and whether the STSP is fit for competing within the industry; opportunity and threat are used to assess the external environment of a corporation, and will be used to assess how the industries in the STSP will evolve going forward. This model of thinking can help analysts consider these for aspects, assess advantages and disadvantages as well as gains and losses, find the actual root of the problem, and design a response strategy. The STSP Bureau has been promoting the development of a green energy and low-carbon industrial cluster. It conducted opportunity analysis based on its own developmental conditions through four main facets, avoiding pressure from primary threats, making good use of resources, taking advantage of its advantages, and making up for its disadvantages. It uses SWOT analysis in policy studies for promoting the green energy and low-carbon industrial cluster, which is helpful towards the STSP Bureau's future promotion of the green energy and low-carbon industrial cluster, allowing it to take advantage of the park's advantages, improve upon the park's disadvantages, strengthen the park's opportunities, and avoid potential external threats.

Based on Michael Porter's definition[5], [6] of industry clusters as well as Kenneth R. Andrews' SWOT technique[7], [8], this study will find a suitable and effective marketing strategy for the STSP Bureau to use in establishing a green energy low-carbon industry, understanding the advantages and disadvantages of the STSP in developing a green energy low-carbon industry cluster, and recognizing future opportunities and challenges going forward.

RESULTS & DISCUSSION

In 2011, the output of Taiwan's green energy and low-carbon industry was already valued at 410 billion NTD, with its solar and optoelectronics as well as LED lighting industries gaining strong global market shares. Many materials, electronics, electromechanical, and mechanical process technologies and equipment have strong potential in terms of entering the green energy and low-carbon industry. In its "2010 Annual Global Competitiveness Report," the Swiss International Institute for Management Development (IMD) ranked Taiwan 6th in the world and 2nd in Asia in terms of potential due to its usage of green technologies to create competitive advantages, which shows that Taiwan's green energy and low-carbon industry has already been recognized internationally for its global competitiveness[4].

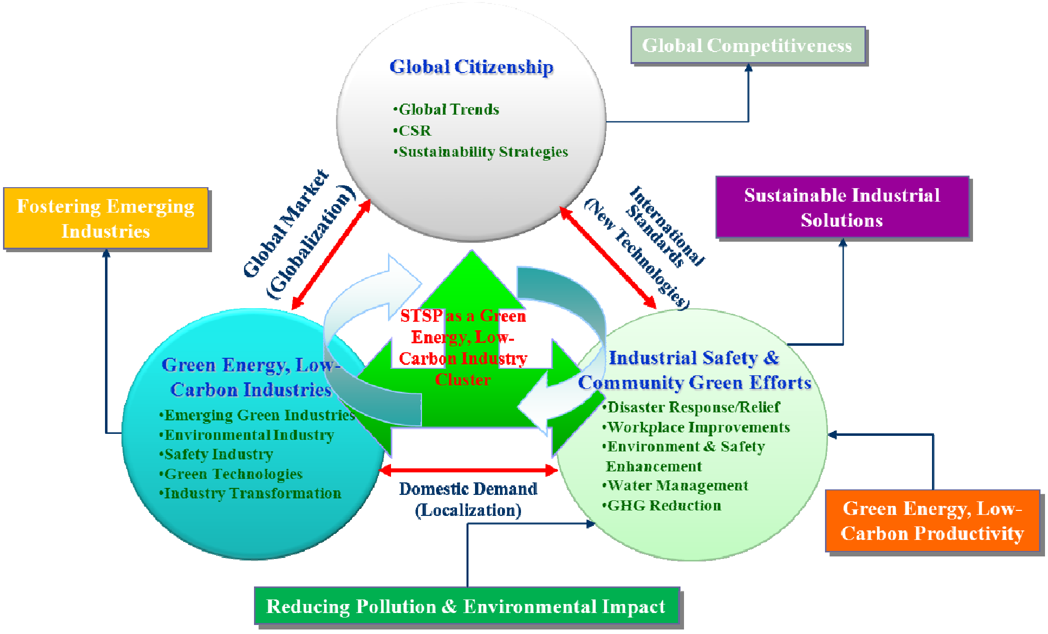


	2008	2009	2010	2011	2012	2013	2014(E)	2015(F)	2016(F)	2017(F)	2018(F)
Otput	1.6	2.2	3.9	4.1	3.7	4.2	5.1	6.4	7.5	9.1	11.6
YoY		35%	82%	6%	-10%	13%	21%	24%	18%	22%	27%

Source: Office for the Promotion of Green Energy; and results from this study; 2014/07

Figure 1: Output analysis for Taiwan's Green Energy and Low-carbon Industry[4]

In other words, in terms of technologies and industries that must compete in the global market, the STSP's low-carbon green energy industry cluster undoubtedly plays a key role. By taking advantage of various human resources, material resources, financial resources, the National Portfolio, as well as portfolio analysis and strategic analysis of various emerging industries, the STSP allocates its resources to the development of sectors that have the potential to be the most effective. It also engages in the adjustment of various economic, political, and legal regulations, thereby leading the way toward industry advancement. Taiwan's over-reliance on its high-tech electronics industry and neglect of the developmental opportunity brought forth by green energy and low-carbon industries as well as the green economy have resulted in an overly-rapid bust in Taiwan's high-tech electronics industry as well as serious structural imbalances in its industrial structure. In the face of changes in the domestic business environment as well as globalized economics and trade, industries must adapt their strategies according to the times to achieve sustained growth. In addition to effectively using factors of production such as natural resources (land, energy, and water resources), capital, technology, and human resources, providing services such as IT, communications, financial insurance, venture capital, and corporate consultation in order to overcome the current challenges in industry and boost the competitiveness of the green energy and low-carbon industries, it should also actively improve the investment environment to make businesses willing to invest in Taiwan in order to create a new era for Taiwan's industries.



Source: Compiled for this study; 2014/07

Figure 2: The STSP's plans for developing the green energy low-carbon industry cluster

The analysis in this study shows that the ideal government policy is one in which the government plays the role of a catalyst or challenger, encouraging and promoting the visions and goals of businesses. The government should also guide businesses in the direction of enhancing their competitiveness and commit to creating an environment in which businesses can create their own competitive advantages instead of directly assisting those businesses or intervening with their situations. The STSP is driving the establishment of a comprehensive industrial-park ECO-System through the execution of its green energy and low-carbon industry cluster policy, providing unparalleled service for investors who wish to establish companies, engage in production, or carry out sales operations in the STSP. These services include: combining R&D efforts from industry, academia, and the research sector; research and development, testing, and certification of advanced clean energy technologies as well as energy-saving and carbon-reducing products in the STSP; and providing subsidies and guidance to innovative and high value-added research efforts, as well as connecting potential subjects with central government resources. The STSP assists those who wish to invest in establishing companies in the STSP with finding capital, talent, technology, and marketing services that match their needs, in hopes of developing STSP into important part of the global low-carbon living circle as well as a key renewable energy industry cluster, thereby laying the foundation for the sustainable and long-term development of the green energy and low-carbon industry cluster.

In economist Kenneth R. Andrews' Economic Strategic Development Model, STSP vendors basically must face competition from the global market. For the green energy and low-carbon industry, government policy and guidance will undoubtedly play a critical role. The STSP Bureau can take advantage of government resources to apply the limited available resources to areas that are most effective through well-coordinated measures, green energy and low-carbon industrial combination analysis, as well as strategic methodologies. For example, when promoting the industrial cluster, the STSP Bureau will comply with the central government's Sustainable Energy Policy Guidelines, with states that sustainable energy development should take "energy safety," "economic development," and "environmental protection" into account, as well as satisfy the developmental needs of future generations, creating a win-win situation for the next-generation energy industry, environmental protection industry, and economy. Its measures include (1) increasing energy efficiency (2) developing clean energies (3) ensuring stable sources of energy. In the future, through cooperation between vendors and academic as well as research institutions, the last mile of the commoditization of patented technologies will be achieved. The execution of this plan is based on research and advanced technologies developed through the "National Energy Technology Plan," as well as applications developed via the "Green Energy Industry Dawning Project," taking advantage of their successful results and implementing product development and technological upgrade at the STSP, thereby achieving the Executive Yuan's goal of the industrialization of inventions and patents from the "Four Major Smart Industries" and making the government's subsidiary resources available to industrialization efforts. Another goal is to grow deep roots in the STSP, allow it to contribute its maximum effectiveness, and thereby facilitating the formation of the high-tech industrial cluster. In summary, STSP efforts of developing a green energy and low-carbon industrial cluster should not only combine government resources and supportive measures, but also truthfully consider its own advantages and inherent disadvantages. It must also take full advantage of future development opportunities and avoid possible external threats. Knowing yourself as well as your enemies is winning half the battle. STSP's policies for promoting the green energy low-carbon industrial cluster must be sure to integrate Kenneth R. Andrews's SWOT analysis in order to find the optimal developmental strategy. SWOT analysis for STSP's development of a green energy and low-carbon industrial cluster is as follows:

A. Strengths

(1) The central and local governments already understand the importance of energy conservation and low-carbon development, resulting in the formulation of various policies and the availability of many resources that are advantageous toward local development of low-carbon industrial clusters.

(2) Southern Taiwan receives significantly more sunlight than other areas, which is advantageous toward the development of solar energy and electricity generation and there exists an enormous market for installation and testing.

(3) Industrial areas close by the STSP have many metal and fastener processing plant clusters, which are traditional industries with high-energy consumption. If energy technology service companies were to be established there, they could provide service to the local industries and upgrade their production processes.

(4) Southern Taiwan is home to highly dense steel, petrochemical, and thermal power industries, which makes it ideal for engaging in research related to cleaning catalysts, carbon capturing, and carbon sequestration.

(5) STSP's Kaohsiung campus already is home to a nuclear research facility, a telecommunications technology center, as well as a metals research center, which is relatively advantageous to the formation of a low-carbon industrial cluster in the future.
(6) The STSP is located close to many production and contract manufacturing industries, which gives it the competitive advantages of rapid mass production as well as low cost, making it easy for it to complete the establishment of a complete supply chain.
(7) The LED lighting industry is receiving strong support from relative government agencies as well as many supportive government policies.
(8) Taiwan possesses an abundance of optoelectronic and semiconductor talent, which lowers its entrance barrier into the solar power battery field. Taiwan also has high-quality production management capabilities and produces quality goods and services.
(9) Taiwan's education system emphasizes creativity and breadth, resulting in the creation of talented designers that can learn rapidly as well as quickly absorb new knowledge.
(10) The "Energy Management Act" states that those who use large amounts of energy must establish energy auditing systems and establish as well as execute energy conservation plans and goals.

B. Weaknesses

(1) LED components, product standards, and testing and validation specifications are lacking. In addition, inspection and quality certification capabilities of relative energy products are in need of improvement.
(2) The government purchases electricity at relatively low prices, providing little incentive. In addition, it is relatively difficult to set up wind power plants in Taiwan, making it difficult for small-scale players to enter the sector.
(3) Taiwan relies on foreign vendors to provide key components as well as equipment and materials.
(4) The industry tends to pay more attention to short-term results and tends to turn away from energy conservation plans that require a longer period of time to obtain a return on investment.
(5) Taiwan's industrial areas and science parks have clustered characteristics, with vendors having a high level of similarity, making it more difficult to integrate of regional energy supply chains.
(6) Professional certification systems have not been adequately implemented, resulting in the loss of professional talent and making it difficult to ensure the quality of industrial low-carbon projects.

C. Opportunities

(1) The US, Japanese, Korean, and Chinese governments are promoting the establishment of national low-carbon ecosystem projects, resulting in the rapid development of the global industry.

(2) Global awareness toward the energy crisis as well as the "Kyoto Protocol" taking affect will make the general public more aware of the importance of the energy issue, whereas the only way to reduce CO_2 emissions and the cost of energy is to save energy.

(3) Government policies, incentives, and guidance measures will eventually increase vendor willingness to participate in this industry, which will in turn further boost the effectiveness of energy conservation policies.

(4) Energy efficiency standards management and the promotion of energy conservation measures are part of the core policies of governments around the world.

(5) Driving the manufacturing industry toward a low-carbon structure, reducing CO_2 emission densities by 2% each year, and the developing potential renewable energy industries, new energy conservation and carbon reduction industries, as well as alternative materials as part of the government's core future energy policies.

(6) The Kaohsiung area, including the energy sector, emits a total of more than 10 million tons of greenhouse gases per year, accounting for approximately 1/3 of Taiwan's total carbon dioxide emissions, but only represents about 12% of Taiwan's population, which is why it has an urgent demand for carbon reduction of its industries.

D. Threats

(1) Mainland China is actively developing its LED lighting industry as well as relative applications. Although its industrial technologies lack behind those of Taiwan, it has an enormous market and its cost advantages are significantly greater than those of Taiwan.

(2) The United States, Europe, and Japan are already investing heavily in CO_2 sequestration research. Relative R&D in Taiwan is still in its early stages and will be threatened by advanced technologies as well as patents from countries such as the US, Europe, and Japan.

(3) South Korea and Mainland China are already engaging in legislation regarding green products and specifications, whereas Taiwan has not yet begun such legislation. Japan and South Korea's large electronics vendors are leading the materials and components industries in strategic planning of the green materials and components industries, whereas Taiwan have not yet begun integrating with large vendors in Europe or the US, nor has it had any successful applications to this date.

(4) Slowing of the pace of vendors' investment and expansion efforts: due to the effects of the economic cycle, which has resulted in over-production and the availability of cheap electrical power, the profits of vendors have dropped, making them more conservative toward expansion investments and making them less willing to build new plants or participate in exhibition events.

(5) Trends in renewable energy development are unclear, while Taiwan lacks inspection and validation standards as well as execution institutions.

(6) Taiwan lacks global certification laboratory capabilities and qualifications. We only possess design capabilities but lack product quality validation abilities, resulting in good

designs not receiving proper recognition and talented people not being noticed. This makes it even more difficult to attract more talent.

According to the SWOT analysis, before the STSP establishes its industrial cluster, it must first develop its industrial ECO-System. In order to develop its industrial ECO-System, it must first establish relative industry testing, verification, and global promotion platforms, as well as accelerate product time-to-markets, increase market acceptance of green energy low-carbon products from Taiwan, and facilitate combined marketing for vendors within the industry cluster. Through industry cluster exhibition areas and combined marketing, the increasing of the output of the green energy and low-carbon industry cluster can be accelerated. The STSP also provides assistance with strengthening industry R&D capabilities, allowing vendors to quickly obtain R&D resource assistance through the establishment of a shared service platform between academia and the research community, thereby being able to inherit the accumulated achievements of the industrial, academic, and research sectors, and accelerating product development. In addition, domestic and foreign investment should be attracted through establishing national image exhibition booths at international exhibitions as well as the holding of vendor meetings, which will help create additional opportunities for Taiwan to further develop its industries and effectively attract domestic and foreign high-tech vendors to invest and set up offices in the park, thereby adding to the overall industrial technology capability level and competitive advantages of the park.

In addition, the results of the SWOT analysis also show that in order to develop its industrial cluster, the STSP must first strengthen its vendors' low-carbon energy technologies and product R&D capabilities. The future green energy and low-carbon industrial cluster must integrate industry, academia, and research institutions (especially schools such as National Cheng Kung University, National Chiao Tung University, National Sun Yat-sen University, and I-Shou University, etc., which are situated in advantageous geographic locations) as well as relative research institutions (such as the Institute of Nuclear Energy Research, the Telecom Technology Center, the ITRI South Campus, and the Metal Industries Research and Development Center, etc.), and engage in advanced clean energy technology research, testing, and certification at the STSP. It must also introduce green energy, energy conservation, and carbon reduction industries to build the STSP into Taiwan's first and most prestigious low-carbon industrial cluster, as well as form an exemplary park combining a low-carbon living circle with a renewable energy industrial cluster, turning southern Taiwan into the home of advanced low-carbon and green energy technologies. In addition, we hope to accelerate the transformation of southern Taiwan from its current high-carbon industrial characteristics to a low-carbon economic model. Our goal is to build this area into Taiwan's largest low-carbon industry and validation cluster, which is why our plans include to: establish strategic planning, technology match-making, industry-academia collaboration, developing talent, marketing and attracting investment, as well as testing and verification platforms, thereby driving the development of low-carbon industry clusters in Southern Taiwan, attracting corporations to establish locations in the STSP, increase investments, create jobs, and develop professional talent for the green energy and low-carbon field.

The STSP Bureau not only strives to promote low carbon green energy industries, but is also actively builds the industry cluster and promoting environmental conservation, resulting in the rapid growth of green buildings within the park. Statistics show that there are ten buildings in the STSP that have obtained diamond-class green building certification and two that have obtained gold-class green building certification, making the STSP the park with the highest green-building density and the best green-building quality in Taiwan. The STSP is almost an exhibition area for Taiwan's green buildings. Today, the STSP Bureau is even more actively engaging in green factory and green science park construction projects. There are already six factories that have obtained green factory certification, representing 1/3 of the obtained certifications in the country. The STSP is also the park with the highest green-factory certification density in Taiwan, and plans to march forward towards becoming a "Ecological Science Park." Apply UNEP's definition, which states that the green economy is "a type of economic activity that reduces environmental risk and ecological destruction, thereby improving the well-being of humans and human society" [1].

TSMC & Delta =LEED-GOLD

EEWH-DIAMOND

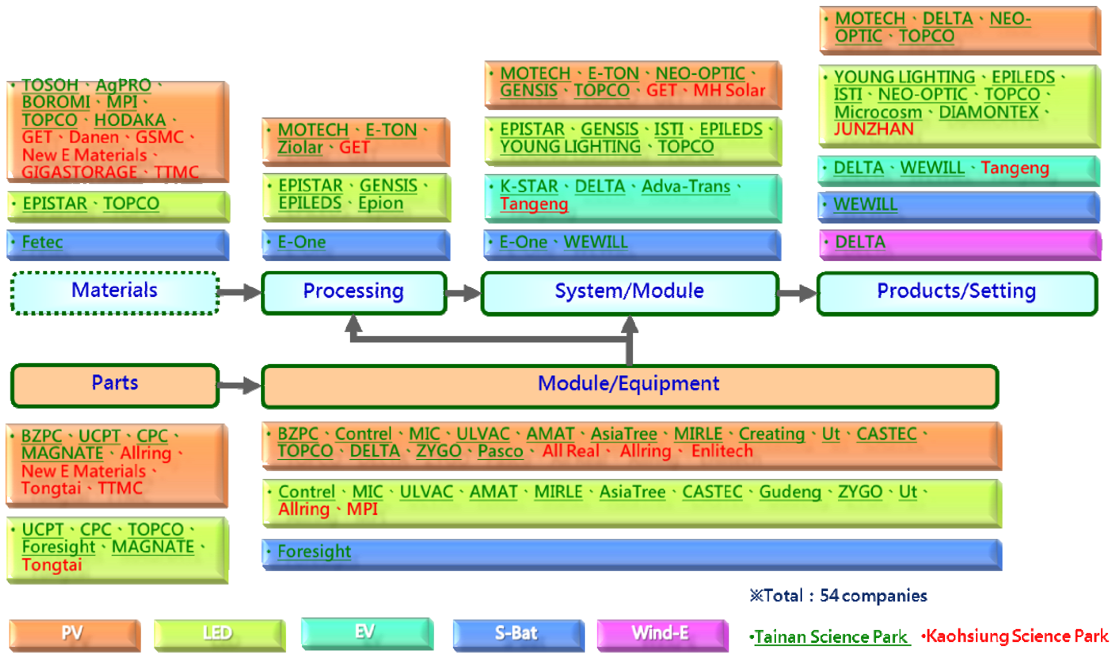
Green Building Guided Tour Map Green Park Website: http://gsp.stsipa.gov.tw/

Source: STSP Bureau, compiled for this study; 2014/03

Figure 3: The STSP ecological community - introduction to green buildings and solar power facilities[9]

CONCLUSION

Under the effects of global climate change as well as the trend of energy conservation and carbon reduction, major countries around the world are actively promoting the development of their green energy and low-carbon industries. In the past, Taiwan has been a critical player in the ICT industry, and with the transformational developments of the global industry, it must now quickly enter the global green energy and low-carbon industry in order to secure a place for Taiwan in the industries of the future. Despite the fact that Taiwan lacks natural resources, it has shown that it possesses global competitiveness in terms of manufacturing capabilities as well as the research and development of advanced technologies through the development of its ICT industry in the past. By developing industries for green energy as well as low-carbon technologies, Taiwan will be able to strengthen foundation of its industries and establish itself as a key provider of green energy and low-carbon technologies and products. Development of the Friends of the Green Energy and Low-carbon Industry Project will not only strengthen the innovative R&D and application capabilities of Taiwan's green energy and low-carbon industry, but will also accelerate the penetration and upgrading of relative industrial technologies, thereby boosting the value of the industry and leading Taiwan's industries toward transforming into green energy, low carbon, and high value-added industries. In light of this, the STSP Bureau is dedicated to promoting and executing its green energy and low-carbon industrial cluster policy, as well as to integrating the industrial cluster with the STSP's own unique "Ecological Science Park," guiding the park towards further industrial development and stimulating investments in the green energy and low-carbon industries, including in fields such as solar power, LEDs, lithium batteries, and electric vehicles. As of the end of January 2014, 21 vendors have been approved to set up offices in the STSP, representing a total investment value of 35.689 billion NTD. We will continue promoting the development of the low carbon and green energy industries through industrial guidance programs and marketing, as well as by taking advantage of measures by the local government to expand the usage of cloud-based applications. In other words, the STSP Bureau is actively promoting the formation of the STSP green energy and low-carbon industrial cluster through means of economic, political, and legislative adjustment, and hopes to be able to combine the cluster with the STSP Ecological Science Park to form the world's only science park that integrates elements of daily life with those of industry.



Source: STSPB & MIRDC; 2014/06

Figure 4: The STSP green energy and low-carbon industry cluster industrial chain

Most existing science parks use GDP as the key indication of park development, however, the damage inflicted on our environment and the over-consumption of our natural resources due to economic development can never be repaired. In most industries, the more raw materials used, the more waste and carbon emissions produced, which in turn affect the living environment of human beings. How to balance economic development and environmental conservation, integrating industrial development with daily life, will be a major indicator for future science park development. After all, science parks are not just industrial zones, and their goals are not only to blindly maximize production and manufacturing, but instead to integrate economic development as well as park infrastructure into the ecological circle through guided technological development, thereby establishing a complete park-industrial ECO-System. In fact, global green economy guru Costanza published in NATURE magazine (VOL 387 15 MAY 1997 253) an article titled "The value of the world's ecosystem services and natural capital,"[10] strongly advocating the inclusion of the value of ecological services into calculations of economic development. Costanza has strongly advocated the green economy concept in order to highlight the severe bias that has long existed in our views toward economic growth as well as the need to correct these views. Constanza believes that economic calculation models that emphasize GDP fail to reflect actual development and cost since they only reflect activities pertaining to market economies and leave out factors that facilitate human well-being. This model of traditional economic thinking based on the pursuit of growth through stimulating material consumption is not only non-sustainable, but even counter-productive.

Constanza's research also points out that future economic calculations for the development of the sustainable green energy and low-carbon economy must use the GPI (Genuine Progress Indicator), which is also referred to as the ISEW (Index of Sustainable Economic Welfare), with four cost categories that need to be considered: human production costs (hardware infrastructures that support human society, such as public facilities, roads, houses, etc.); human capital (such as individual health, education, brain power, household labor, volunteers, leisure hours, time lost during commutes, etc.); social capital (such as interpersonal networks, policies and regulations, low employment, broken families, crime rates, etc.); and natural capital (resources in our lands, ecosystems as well as the services they can provide, etc.) In reality, all of these will become important indicators for the STSP Bureau's planning of the STSP Green Energy and Low-carbon Industrial Cluster. Going forward, the STSP will not only be a science-based industrial park, but also a force for integrating people, people's lives, families, work, and the economic development of the nation. Life in the STSP will drive a green-energy and low-carbon societal structure, as well as help create a green energy low-carbon industrial ECO-System. Going forward, the STSP will continue to follow international developments in environmental conservation, industrial development, and policy implementation, gradually developing into an innovative science park for a green economy and a low-carbon society. The STSP will redefine the hardware infrastructures and software planning required for green industrial parks as well as their corresponding supportive policies.

REFERENCES

[1] United Nations Environment Programme (UNEP), 2009, "Global Green New Deal Policy Brief ".

[2] United Nations Environment Programme (UNEP), 2009, "A Global Green New Deal for Climate, Energy and Development ".

[3] United Nations Environment Programme (UNEP), 2011, " Towards a Green Economy: Pathways to Sustainable Development and Poverty Eradication –A Synthesis for Policy Makers ".

[4] Industrial Development Bureau, Ministry of Economic Affairs,2012, " Yearbook of the Republic of China 101 years of industrial development"

[5] Michael Porter,1990, "Competitive Advantage of Nation ", Harvard Business Review

[6] Michael Porter,1980, " Competitive Strategy ", Free Press, New York.

[7] Humphrey, Albert , 2005 , "SWOT Analysis for Management Consulting", SRI Alumni Newsletter (SRI International).

[8] Thomas L. Wheelen , J. David Hunger,2006, " Strategic Management & Business Policy ", Prentice Hall

[9] Chia-Chang Chang & Chun-Wei Chen ,2010, "Adoption of Sustainable Approaches towards a Green Science Park: The Case of Southern Taiwan Science Park ", 2010 IASP World Conference

[10] Robert Costanza,1997, "The value of the world's ecosystem services and natural capital " NATURE VOL 387

（二）醫療器材

Building Ecosystem to Spark Innovation-based Growth in Medical Devices Industry in Southern Taiwan Science Park

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ABSTRACT

How to construct the innovation ecosystem is a key issue in recent years, especially in the biomedical field. Under the promotion of the Southern Taiwan Science Park Bureau (STSPB), the Phase I of the Southern Taiwan Medical Device Industrial Cluster Development Project (between 2009 and 2012) successfully assisted with the technology upgrading of traditional industries. With a "Upgrading of Traditional Industries" core strategy, the STSPB attracted the presence and investment of 36 tenant enterprises. The focus of the Phase II project (from 2013 to 2016) is to establish a clinical innovation ecosystem.

This study examines 6 important elements to establish the clinical innovation ecosystem in Phase II project, which are talent cultivation, technology integration, incubator, legal counselling and product tests of biomedical devices, venture capital and government resources. A concept of a new medical product is frequently created and presented between communication between R&D engineers and physicians. Thus, STSPB designed a set of training programme for both R&D engineers and physicians to obtain updated technologies and latest knowledge. The integration of clinical needs and the technology is also a key factor for innovative medical products. The establishment of incubation center for the startup companies provides the service of business consultation and assistance. Before launching to the market, regulation consultation and product inspection are both necessary for the medical device products. Furthermore, the funds from venture capital and subsidy from the government support the development of innovative medical products. Therefore, above-mentioned 6 elements construct the "clinical innovation ecosystem".

KEYWORDS: Medical Device; Southern Taiwan Science Park; Industry Cluster

1 INTRODUCTION

This article proposes that the appropriate way to create a picture of biomedical innovation ecosystem connections is to address the question of the respective roles within the system of key innovation actors.

An applied Triple Helix model (Etzkowitz, 1997; Leydesdorff, 2006) captures the multiple reciprocal relationships of the public-private-academia innovation activities, where each performs its respective role while actively seeking value-added collaborative arrangements for upgraded, shared results.

Regional innovation policy initiatives are driven by the fundamental aim of bringing together key actors within a given region or district for joint innovation activities. The Triple Helix model has been widely adopted to help identify the key linkages and core functions between the public sector, academia and private companies. However, this and other traditional collaboration models and frameworks have evidently remained too generic and abstract, and consequently, produced only nominal results in guiding regional innovation processes. It is important to note that the true nature of regional innovation ecosystems (RIE) is necessarily much more complex than understood so far, and thus, needs to be addressed in a more comprehensive and systemic way to provide functional guidelines for the development of operative innovation platforms. The Triple Helix and other models need to be complemented with market aspects, demand factors, and increased participation of citizens as users and developers of innovation. The models need to be supplemented with smart orchestration practices bringing together key stakeholder interests, and extended to address the specific challenges related to the value system competition in global contexts. Regional innovation policy initiatives are driven by the fundamental aim of bringing together key actors within a given region or district for joint innovation activities. The Triple Helix model has been widely adopted to help identify the key linkages and core functions between the public sector, academia and private companies .However, this and other traditional collaboration models and frameworks have evidently remained too generic and abstract, and consequently, produced only nominal results in guiding regional innovation processes. It is important to note that the true nature of regional innovation ecosystems (RIE) is necessarily much more complex than understood so far, and thus, needs to be addressed in a more comprehensive and systemic way to provide functional guidelines for the development of operative innovation platforms. The Triple Helix and other models need to be complemented with market aspects, demand factors, and increased participation of citizens as users and developers of innovation. The models need to be supplemented with smart orchestration practices bringing together key stakeholder interests, and extended to address the specific challenges related to the value system competition in global contexts.

The pioneering activities of regional innovation ecosystems have largely centered on the mutually complementing challenges of fostering the local pools of know-how and knowledge co-creation, as well as managing and orchestrating the actions of stakeholder groups. The most attractive regional innovation ecosystems (RIE) have been built on a strong knowledge base, accumulating network of complementing innovation processes, and advanced combinations of innovation resources, especially talent, funding and infrastructures (Launonen & Viitanen, 2011). The top RIEs have managed to channel the accumulation of academic knowledge to joint innovation activities and to integrate the related outcomes with the market-driven commercialization processes.

The Triple Helix model (collaboration between academia-industry-public -sector) and the Knowledge Triangle approach (synergy between research-education-innovation) have been adopted to explain the related dynamics and to justify the interlinked relations of the collaborative stakeholder groups. They address the challenges in transforming the highly specialized talent pools into productive co-creation enablers and in harnessing the complementing processes for synergetic outcomes. However, this article argues that in the traditional stakeholder group models and intra-regional analyses provide inadequate support for RIEs preparing for biomedical area innovation model.

The future top RIEs will be embedded in a more globalized, interconnected and collaborative context, where digitalization is a key driver of change, i.e. information, resources, talent and solutions can flow freely and effectively between mutually complementing and/or competing locations. The accumulation of innovation resources no longer endorses nation states, regions and/or organizations, but instead, they will increasingly build on mutual trust and interest and maximized utility of matching self-interest and collective outcomes.

Under these circumstances, the new role of decision makers becomes a critical success factor. They must prepare for continuous competition in creating the best preconditions for innovation culture and concentrate their efforts on setting up attractive, functional and thoroughly interconnected platforms for effective knowledge and technology transfer and knowledge creation as well as timely commercialization. Accordingly, it is important to address the globalization challenge in relation to overall RIE development and identify the key factors supporting a comprehensive management approach focusing especially on orchestration of new forms and mindsets for collaboration, networking and joint actions.

Medical device industry is a branch of biotechnology industry by definition. Since the Taiwan government has identified biotechnology industry as a star industry of the 21st century, a great deal of resources has been allocated to strength the competitiveness of Taiwan's biotechnology industry as well as medical device industry，Southern Taiwan Science Park Administration decided to consider the development of energy surrounding the medical devices industry. The concept to develop the biomedical device industry was inspired by the combined strength of steel-making and precision machining companies in Southern Taiwan as well as recent technology breakthroughs and interface integration that are required throughout the entire process ranging from product concept, actual production, to market entrance. Resources come from different public and private sectors and no single agency from business, academia, or governments is able to integrate all players within existing administrative boundaries. As a result, the STSP Bureau developed the concept of an interface organization by establishing the "Innovation Services Platform" as the core for resource search, resource integration, and one stop services.

After five years, pushing the overall value of clusters of medical devices gradually improved. STSP Bureau consider the next step, an innovative medical device industry clusters. To become a biomedical industry innovation ecosystem, proposed a major element. 6 important elements to establish the clinical innovation ecosystem in Phase II project, which are talent training, integration of technologies, incubation center, medical device regulation consultation and product inspection, venture capital and government resource. This phase is to the STSP become innovative medical devices industry clusters.

2 LITERATURE REVIEW

2.1 The concept of the platform

What managers and researchers refer to as "platforms" exist in a variety of industries, especially in high-tech businesses driven by information technology such as Google or Intel. It builds hardware and software products as well as applications, and provides a variety of services, from computers, cell phones, to consumer electronics devices that in one form or another serve as industry platforms. All these firms and their partners participate in what we can call platform-based "ecosystem" innovation, (Moore, 1996; Lansiti and Levien, 2004). Platforms are also often associated with "network effects": that is, the more users who adopt the platform, the more valuable the platform becomes to the owner and to the users because of growing access to the network of users and often a set of complementary innovations. As we will discuss later, there are increasing incentives for more firms and users to adopt the platform and join the ecosystem as more users and complementors join.

Gawer and Cusumano (2013) compared existing platforms and categorized them into internal and external ones. Internal (company or product) platforms are a set of assets organized in a common structure from which a company can efficiently develop and produce a stream of derivative products while external (industry) platforms such as products, services or technologies are similar to the former but provide the foundation upon which outside firms (organized as a 'business ecosystem') can develop their own complementary products, technologies, or services, (Gawer and Cusumano, 2002; Gawer, 2009).

2.2 The concept of a business ecosystem

According to Moore (1996) the business ecosystem is made up of customers, market intermediaries, companies selling complementary products, suppliers, and the company itself, which can be thought of as the primary species of the ecosystem. Therefore, the business ecosystem is a field of economic actors whose individual business activities are anchored around a platform.

Within a business ecosystem, the activity of a firm relies on a mesh of relationships characterized by varying degrees of intensity with other partner firms that take a more or less significant part in the innovation process. However, a company may be in a central position because of the business potential it creates for other companies. Business relationships give access to knowledge, technologies, and innovation potential, which make it an attractive partner. Within this framework, the networks represent the foundation on which relationships between firms are organized. Lansiti and Levien (2004) distinguish three types of actors within a business ecosystem:

The Dominators:

One can distinguish between the "physical dominator", whose role consists in dominating all of its ecosystem's niches via integration strategies that enable it to control the maximum number of nodes within its network, and thereby capture the value created for its own benefit. On the other hand, there is a "value dominator" or "hub landlord" whose role is to extract the maximum value from the network without trying to dominate it. In both instances, the objective pursued is to extract the maximum value without redistributing it to other actors. The resulting effect is usually a weakening of the business ecosystem.

Keystones:

This type of actor plays a significant role in both the creation and the redistribution of value created within the network. Contrary to a "dominator", it does not try to control the whole network and its actors, but tries to position itself on a few nodes and assume leadership. The keystones often resort to platform strategies which give them the opportunity to take advantage of the other network actors' contributions by facilitating access to some resources. They usually adopt a "win-win" attitude vis-à-vis the other members of their ecosystem.

Niche players:

There are many such actors, small in size and pursuing a specialization strategy in order to differentiate themselves from the others. They account for a large part of the value created within the ecosystem. The resources they access via the platform made available to them by the keystone give them an opportunity to develop new products or services. Indeed, they maintain very close relationships with the keystone, by actively contributing to the platform's evolution and the dynamics of the ecosystem.

2.3 Innovation ecosystems

As shown in business literature, existing platforms consist of a dominator (in addition to the internal platforms of large scale enterprises) and their business ecosystems are based on the cores of products, services, and technologies. Each member plays both the roles of keystones and niche players. It is worth noting that these business ecosystems do not focus on their geographical locations and there is no role for public or semi-public sectors. In fact, unlike countries in the US and Europe, Asian countries, especially Taiwan, rely on production systems based on small and medium enterprises rather than those of big ones. As a result, industrial and technology upgrading require cooperation between public and private sectors.

If a business ecosystem would like to expand similarly to one in the science parks, the relationship between innovation and the business ecosystem needs to be discussed. Innovative models for enhanced linkages and collaborations can enrich a business ecosystem so that more ideas can surface, more job-creating enterprises can be developed, more companies can find skills and innovation, and more enterprises can increase their capabilities to grow and compete in global markets. Therefore, the term "Innovation ecosystems" can be explained with successful examples of agglomeration whether in geographic, economic, industrial or entrepreneurial terms. In Schumpeter's words, innovation ecosystems are primarily about successful innovative regions (Silicon Valley), or new industries (cloud computing) and entrepreneurs and investors from all over the world jump on the bandwagon of these successes. In short, the STSP and its Innovation Services Platforms are integrated into an “innovation ecosystem" with an Innovation Services Platforms that focuses on the integration of innovation and technology as well as the operation of business model. Innovation ecosystems are based on a business ecosystem and the operation of the business ecosystem is driven by the operation. This study, thus, examines the composite elements of innovation ecosystems as well as the composition structure of Innovation Services Platforms in order to explore the cooperative mechanism between enterprises and academic institutions.

3 THE FIRST PHASE OF THE PROJECT IS TO CONSTRUCT INDUSTRIAL UPGRADING MEDICAL DEVICES INDUSTRY SERVICE PLATFORM

From 2009, the “Southern Taiwan Biomedical Devices Industrial Cluster Establishment Project” was promoted by the Southern Taiwan Science Park Bureau and executed by the Metal Industries Research & Development Centre. The structure of the project is shown in Figure 1. The proposed areas of this project include dental instrument systems, orthopedics instruments, cosmetic surgery equipment or instruments, medical alloys, and other sub-areas such as developing technology, training talents, and building a platform for research and development cooperation among potential bio-medical instrument producers. It aims to stimulate to the development of a national bio-medical instrument industry cluster, inspire firms in the industry to be proactive in their research and develop in order to obtain necessary technology, and integrate relevant academic power and establish a platform for training professionals and relaying expertise among members of the bio-medical instrument industry; furthermore, to promote national competency, to construct an ideal and superior environment for academic research, and to integrate the national research and development force toward the required technology for training hi-tech professionals and promoting expertise in order to develop a thriving industry cluster.

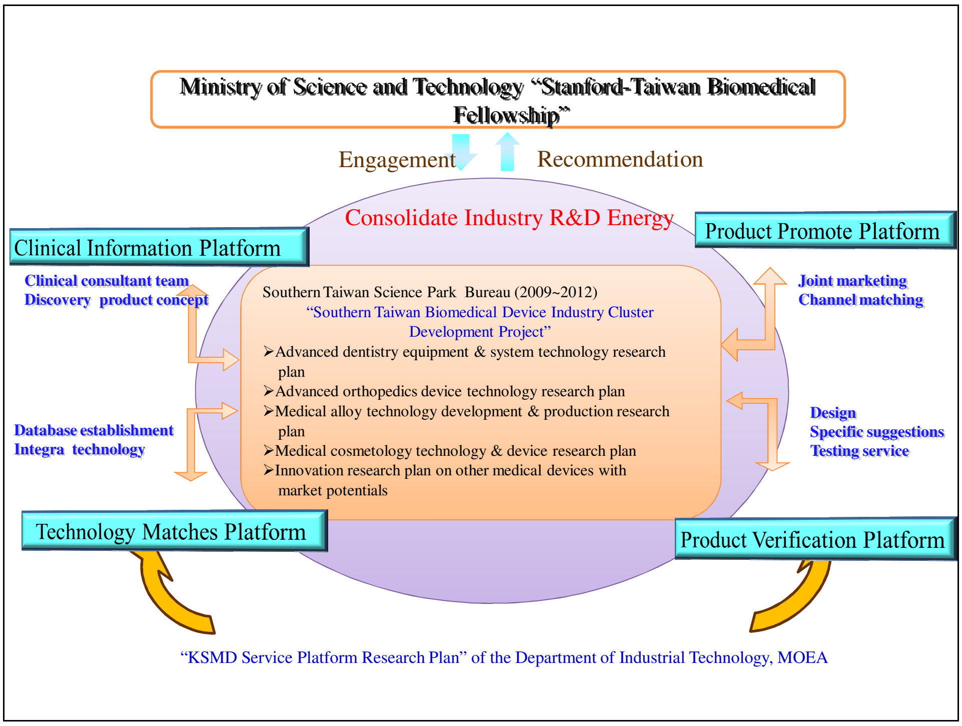


Figure 5:"Stanford-Taiwan Biomedical Fellowship Program" of Ministry of Science and Technology

For this purpose, in the sub-projects of industrial technology R&D platforms, the following platforms have been developed:

(1) Technology matching service platform

The purpose of this platform is to integrate the energy of relevant domestic and international research institutions and schools on medical device studies to form a complete service network and to establish a single window for the provision of quick access to R&D resources by tenant enterprises in order to provide quick product development.

(2) Clinical information platform

The purpose of this project is to satisfy clinical information needs during the medical device product development process. Items addressed include A. to improve clinic information exchange during the R&D process; B. formation of professional teams and R&D discussions; and C. pilot consultation and evaluation of clinical experiments. Through the operation of these three project items, the goal to provide the industry with clinical clinic information can be achieved.

(3) Product launch service platform

The medical device industry has high market barriers, but after products are launched into the market, due to the requirements for accreditation and limits on promotion channels, they have a relatively long product life cycle and impressive profits compared to other industries. It is planned that with this sub-project, resources can be integrated before product launches to reduce costs and improve efficiency and service levels. According to this sub-project, two platforms are constructed for product accreditation and promotion:

A. Product accreditation platform

Ethylene Oxide (EtO) sterilization system, high-temperature sterilization equipment, and relevant sterilization test equipment are required to build a GLP sterilization laboratory (including sterilization system and a packing material aging and fatigue test lab). By working with existing vendors to provide sterilization services and training for practical operators, we help enterprises to improve sterilization effectiveness and manufacturing processes. Additionally, an investigation on the gaps in the domestic sterilization industry has been conducted to develop a new sterilization method to replace the traditional one, to assist with technology updating for the sterilization industry, and to improve domestic medical quality.

The product accreditation service platform will be built and the Metal Industries Research & Development Centre will take charge of the operation. After the Centre becomes the accreditation center for medical device products, the professional skills for accreditation services will be cultivated. Meanwhile, the resources of Taiwan's relevant private accreditation organizations can be integrated for more effective accreditation compliance. Cooperation with international and EU notified bodies can also be facilitated for the mutual acceptance of test reports to save the costs and time of enterprises that are spent on identical tests and reduce the time needed for product launches.

B. Product promotion platform

The purpose of this project is to construct a promotion platform that helps to boost the overall image of Taiwan's medical device industry. Through the establishment of the National Image Pavilion of High-End Products, overseas technology matching seminars, and overseas expansion, the visibility of Taiwan's medical device products has been enhanced. Furthermore, a brand mechanism shall be jointly created to achieve strategic alliances and joint Internet promotions among domestic brand leaders and medical device makers. At the same time, the cluster exhibition is designated in the medical device area to boost product visibility and increase matching opportunities for agents.

4 THE INNOVATIVE ECOSYSTEM OF BIOMEDICAL DEVICE INDUSTRY IN PHASE II

In Phase I, the plan successfully updated the industry and developed the industrial cluster of biomedical industry while in Phase II, the innovative ecosystem of the biomedical industry is expected to be created for building a self-resilient and innovation based industrial cluster at the STSP. The emphasis in this part is put on the operation of cluster innovation to optimally pursue the creation of a self-resilient and innovation based industrial cluster with talent cultivation, technology integration, incubator, medical device legal counseling and product tests, venture capital attraction, and the support of governmental resources.

4.1 Talent cultivation

Talent has long been the industrial competitiveness of Taiwan that led the development of Taiwan's electronic industry. Yet, the biomedical device industry is an interdisciplinary one that needs to recruit physicians, engineerings, and specialists in integration, product laws, intelligency property analysis, and marketing. Talents are critical to the innovative ecosystem and the drive for sustainability. As a result, at the STSP, we have facilitated the exchanges between engineers and a nearby university hospital to enable engineers to observe and know equipment and devices needed by physicians during the surgery processes as well as the clinical need. Physicians, at the same time, also visited the factories to know how manufactures satisfy their demands during the production of biomedical devices.

4.2 Technology integration

The biomedical device industry integrates various engineering in electronics, metal, plastics, and optical sectors and through these technologies, problems of physicians and patients are solved. In this innovative ecosystem, academic and research institutes integrate technologies and provide innovative resolutions to the cluster. Prototype products have then been produced. The coordination and cooperation of academic and research institutes are a starting point, and additionally, enterprises in the cluster are also the link for the supply chain of technology integration.

4.3 Incubator

The biomedical device industry also has a feature that can address to patent and laws before market launch. Hence, initially, there is a waiting period with no revenues. The incubator needs to provide consultation in terms of patent, legal requirement and accreditation, prototype product development, and most importantly, the discussion with clinical physicians. Furthermore, there should be clear ideas about marketing. The incubator provides relevant services to assist enterprises to shorten the waiting time as well as reduce expenditure for speeding up profit making.

4.4 Legal counselling and product tests of biomedical devices

Biomedical devices tie closely to human life, and therefore, a longer period of time is required for the launch of innovative biomedical devices. Compared to general purpose ones, the innovative biomedical devices need to have new test methods, animal lab models, and clinical and experimental tests. These are important to the innovative ecosystem as well as the key to commercialize innovative products.

4.5 Venture capital

In Isralei's innovative biomedical device system, venture capital plays an important role. Taiwan's venture capital recently has gradually increased its investment in the biomedical field, giving a new opportunity to Taiwan's innovative ecosystem of innovative biomedical industry. At present, we conduct match meetings between venture capital and enterprises to promote industrial innovation.

4.6 Governmental resources

In STSP's Phase II Cluster Plan, grants are provided to innovative plans. Through governmental resources, the whole innovative ecosystem has been created. In the future, the system will be able to be operated independently by following the innovative model implemented in the biomedical field in both Silicon in the US and Israel.

5 CURRENT STATUS OF IMPLEMENTATION AND ACHIEVEMENTS

In terms of the drive to promote innovation, the STSPB in 2013 led the first step to create the innovative ecosystem when handling the applications for 2013 open and innovative plans. In 2013, there were 25 plans filed for innovative application and after evaluation, nine were selected with the successful rate of 36%. These plans need to enable technology transfer or set up a new company within one year. Successful applicants were mainly from academic and research institutes and hospital university. In the future, they still need to meet the requirement to transfer technology or set up an innovative company to give more industrial effectiveness to the whole innovative ecosystem. At the same time, academic and research institutes can have more interactions with the industry. There were also five applications field by enterprises, but they were not approved indicating the need for enterprises to enhance innovation and technology integration in the medical system. The two applications focusing on testing devices belong to the innovative field, and so do two for minimally invasive surgery, two of implants, and two for diagnosis systems. These match with the global development trend and the development direction of the health care industry.

Table 1: 25 Cases Applied in 2013 with Nine Approved and the Successful Rate of 36%

Item	Name of Applicant	Name of Plan	Plan Type
1	National Chiayi University	Novel immunological sensing platform for spinal muscular atrophy and diabetes management	Photovoltaic monitoring systems
2	National Cheng Kung University	Development of medical devices for dental and oral/maxillofacial reconstruction surgery	Minimally invasive surgery applications
3	Chi Mei Medical Center	Wireless remote urine amount monitoring system	Photovoltaic monitoring systems
4	Precision Machinery Research Development Center	Single port scarless procedure kit	Minimally invasive surgery applications
5	Feng Chia University	Smart light-cured dental composite resins- preliminary evaluations before product commercialization in vivo	Photovoltaic monitoring systems
6	Kaohsiung Medical University	Bone substitute combined simvastatin carriers to promote bone growth of value-added research	Implant system
7	National Cheng Kung University	Development of Dynamic Spinal Stabilization System	Implant system
8	Industrial Technology	High Frequency Oscillatory	Medical imaging

	Research Institute	Ventilation Technology Development Plan	
9	National Cheng Kung University	Robotic arm for CT scan-guided diagnosis and therapy	Medical imaging

6 CONCLUSION

The STSP Biomedical Device Industrial Cluster in Phase I integrated the surrounding industrial energy of academic, research, and medical institutes through the platform mechanism to facilitate the forming of the biomedical device industrial cluster. Based on industrial demands, the industrial upgrading strategy supplemented with the support of academic and research institutes was adopted. In Phase II, the creation of ecosystem model of the innovative biomedical device industry needs to start from the demands of clinical physicians to lead the overall system. In this paper, the innovative ecosystem in Phase II needs more technology matching, the integration of academia and the research circle, and legal services to satisfy the operation of biomedical ecosystem. Interdisciplinary talents are critical to drive the operation of the whole system, and successful cases will encourage the active participation of venture capital in the industrial operation for a more sophisticated innovative biomedical device ecosystem.

REFERENCES

[1] Etzkowitz, H., " *The Triple Helix: Academy-Industry-Government Relations and the Growth of Neo-Corporatist Industrial Policy in the U.S.*", Campodall'Orto, S. (Ed.): Managing Technological Knowledge Transter, EC Social Sciences COST A3, Vol.4, EC Directorate General,Science, Research and Development, Brussels, 1997.

[2] Laydesdorf, L., "The Triple Helix and Knowledge-Based Innovation Systems. Published in Reberniket, M. et al. (Eds.): Cooperation between the economic, academic and governmental spheres: Mechanisms and levers.", *Proceedings of the 26th Conference on Entrepreneurship and Innovation*, Maribor, Slovenia, 2006.

[3] Launonen, M. & Viitanen, J., "Hubconcepts™ The Global Best Practice for Managing Innovation Ecosystems and Hubs", Hubconcepts Inc., 2011.

[4] Moore, J.F., "*The Death of Competition: Leadership and Strategy in the Age of Business Ecosystems*", John Wiley & Sons, 1996.

[5] Lansiti, M. and Levien, R., "*The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability* ", Harvard Business School Press, 2004.

[6] Gawer A, Cusumano MA, "Industry Platforms and Ecosystem Innovation", *Journal of Product Innovation Management,* forthcoming, 2013.

[7] Gawer, A. and M.A. Cusumano, "*Platform Leadership: How Intel, Microsoft, and Cisco Drive Industry Innovation, Boston, MA, US*", Harvard Business School Press, 2002.

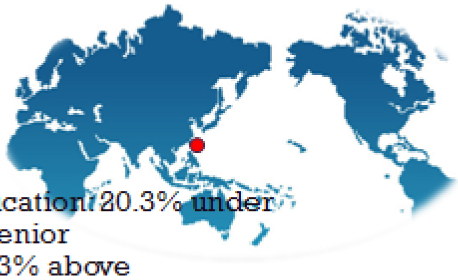
[8] Greenstein, S., "Open platform development and the commercial Internet", in Gawer, A. (ed.), Platforms, Markets and Innovation, Cheltenham, UK and Northampton, MA, US, Edward Elgar, 2009.

四、2014 ASPA 簡報

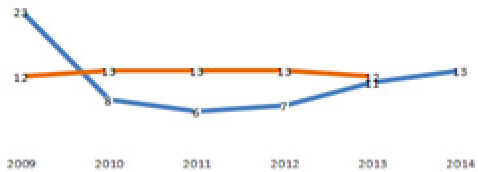
(一) 綠能低碳

I. Taiwan at a Glance

- Population: 23 millions (male: 49.95%, female: 50.05%)
- Area: 36,193.62 km^2
- GDP Growth in 2013: 2.11%
- GNP per Capita: US$21,557
- Unemployment Rate: 4.18%
- Employment by Level of Education: 20.3% under junior high schools, 33.4% senior high/vocational schools, 46.3% above college/university



Taiwan: Highly Ranked in Global Standings



Technological Infrastructure -IMD (60 countries)	
1st	Hong Kong
2nd	Singapore
3rd	US
4th	Taiwan
5th	Malaysia
6th	Sweden
8th	Korea
17th	Japan
20th	China

Scientific Infrastructure -IMD (60 countries)	
1st	US
2nd	Japan
3rd	Germany
4th	Switzerland
6th	Korea
7th	China
9th	Taiwan
17th	Singapore
26th	Hong Kong

Innovation and sophistication factors -WEF (148 countries)	
1st	Switzerland
2nd	Finland
3rd	Japan
4th	Germany
5th	Sweden
9th	Taiwan
19th	Hong Kong
20th	Korea
34th	China

Source: The World Competitiveness Yearbook 2014 (IMD), May 2014 ; The Global Competitiveness Report 2013-2014 (WEF), September 2013.

5

II. Global Warming Threat

·Under ongoing greenhouse gas emissions, the Earth's surface temperature could exceed historical levels as early as 2047 affecting most ecosystems on Earth and the livelihoods of over 3 billion people worldwide.

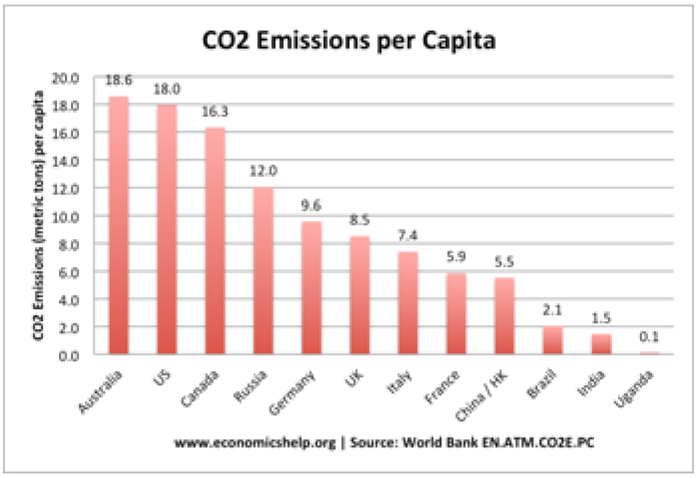
6

What Causes Greenhouse Gas Emissions?

- There are 2 ways that greenhouse gases : through natural processes and human activities.
- The main human sources are: fossil fuel use, deforestation, intensive livestock farming, use of synthetic fertilizers and industrial processes.

+ A list of CO2 Emissions by Major Countries

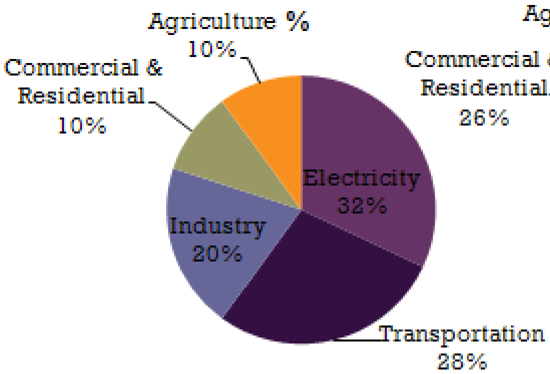
7

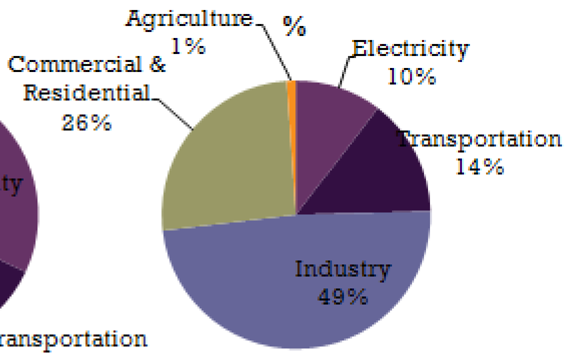


+ Greenhouse Gas Emission in 2012

8

USA	Taiwan





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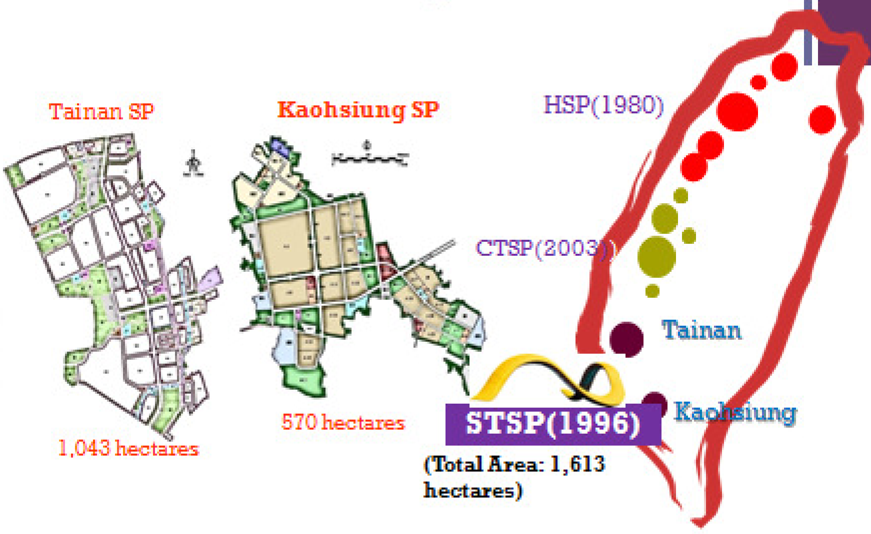
III. STSP Strategies

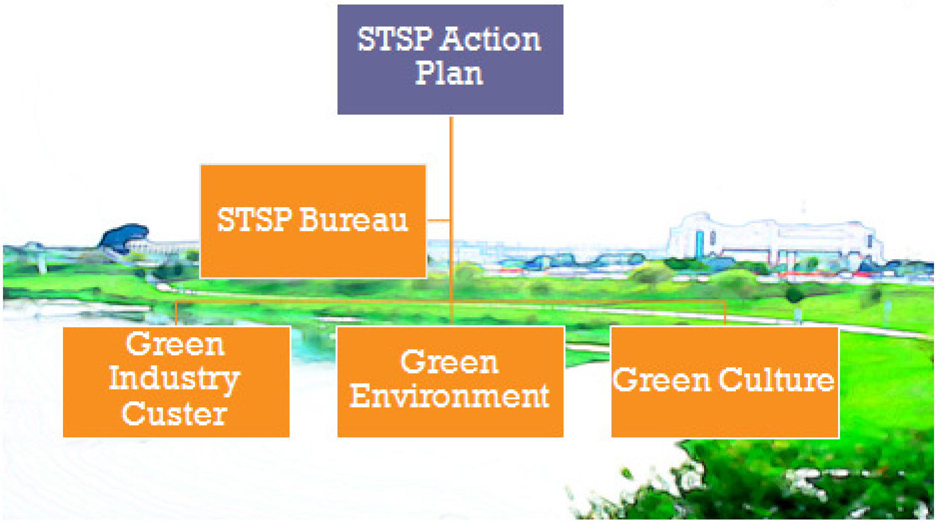


10

STSP Statistics

- Recruited Tenants: 361
- Employees: 76,625
- 2013 Annual Sales: 20.5 billion USD
- 2013 Importing: 13.9 billion USD
- 2013 Exporting: 10.3 billion USD

Sustainable Green Science Park



1. Green Industry Cluster

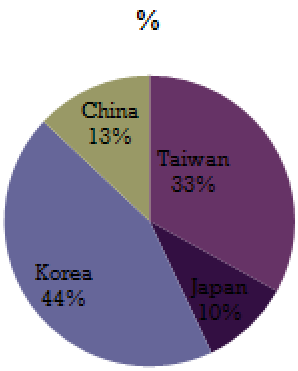
Photovoltaic	LED	Electric Vehicle	Secondary battery

※Total：29companies

13

The Strongest TFT-LCD Cluster

2013 Market Share



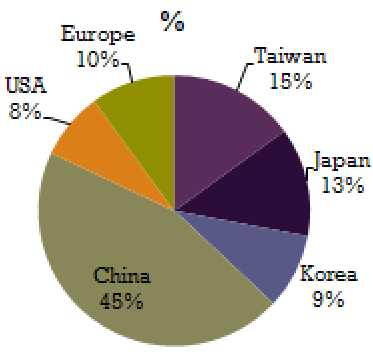
2013 Production Value

Country	Million USD
Taiwan	41,544
Japan	12,936
Korea	56,357
China	16,290
Total	127,127

14

The Brightest Energy Photonics Cluster

2013 Market Share

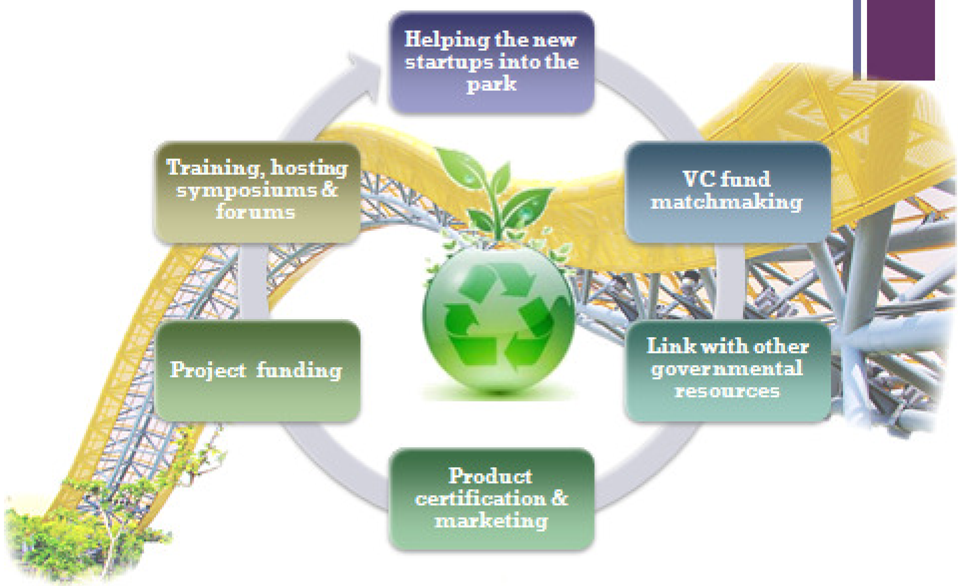


2013 Production Value

Country	Million USD
Taiwan	8,109
Japan	7,075
Korea	4,825
China	23,742
USA	4,398
Europe	5,366
Total	53,515

15

STSP Service Platform



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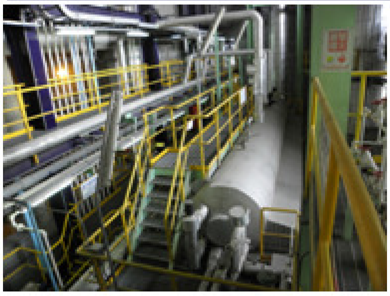
2. Green Environment

Clean Production	Waste Reduction
	
Environmental Protection Center Wastewater Treatment (100% sewer treatment rate, 100% Qualified Rate of Effluent, 90% SS and BOD Reduction Rates, 75% COD Reduction Rate)	Resource Recycling Center Waste Reduction and Disposal (67% Reuse Rate, 100% Proper Disposal Rate)

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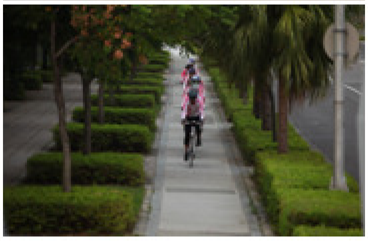
2. Green Environment

Green Traffic

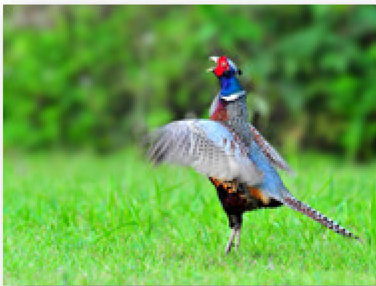


Green Building

18

Green Area

- Designated Industrial Zone: 46%(747ha.)
- Green Coverage Rate>46%(745 ha.)
  - 17 parks: 172 ha.
  - 30 ha. ecological reserve
  - 66 bird species



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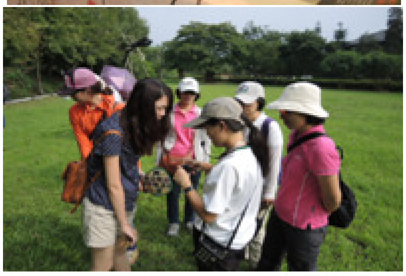
3. Green Culture



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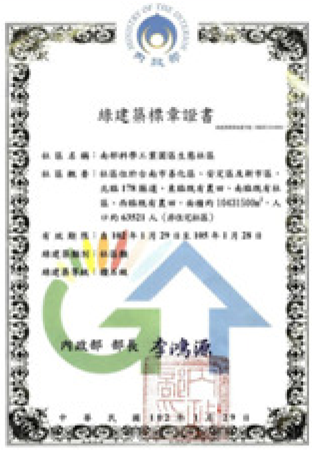
Sustainable Development

21

IV. Conclusion

Ecological Community

Tainan Science Park	Kaohsiung Science Park
	

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STSP Vision

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Welcome to STSP!
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(二) 醫療器材


Building Ecosystem to Spark Innovation-based Growth in Medical Devices Industry in Southern Taiwan Science Park
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- Industry clusters Future Strategy
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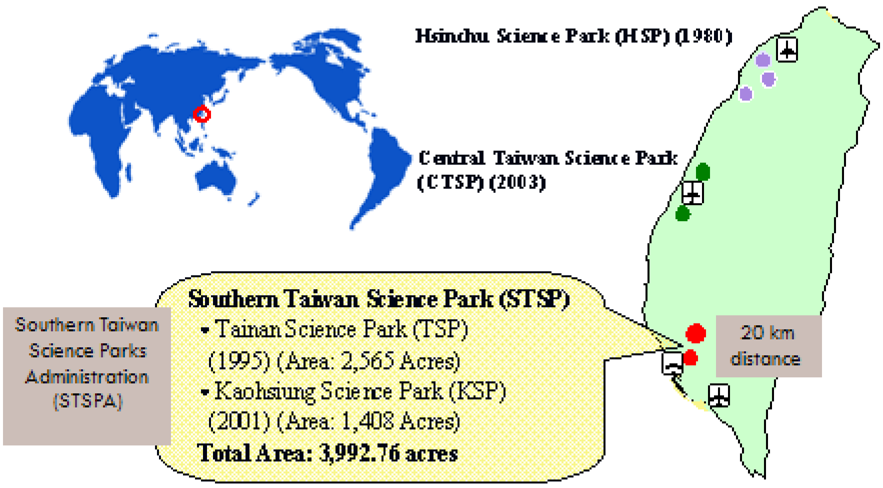
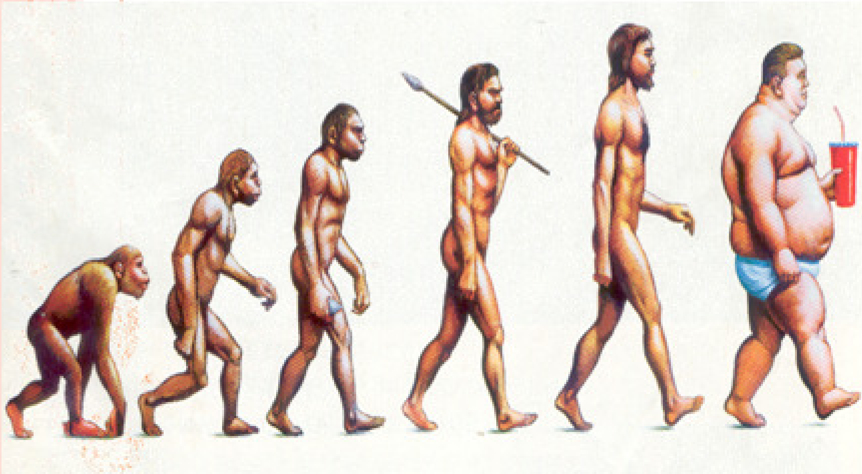
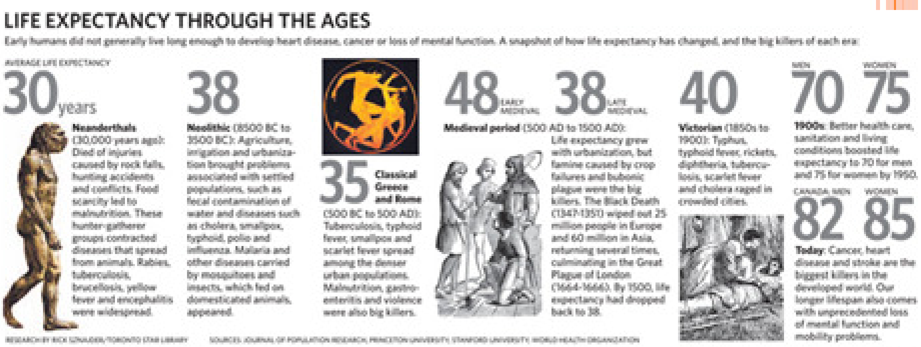
STSP location in Taiwan

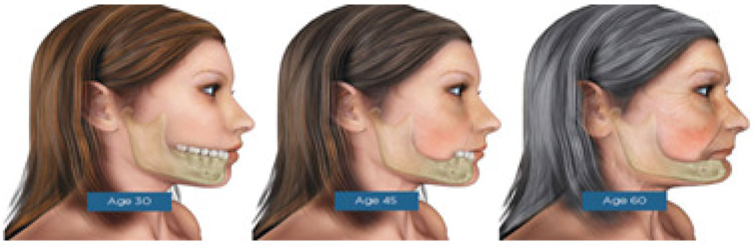


Select the direction of development



Global Aging





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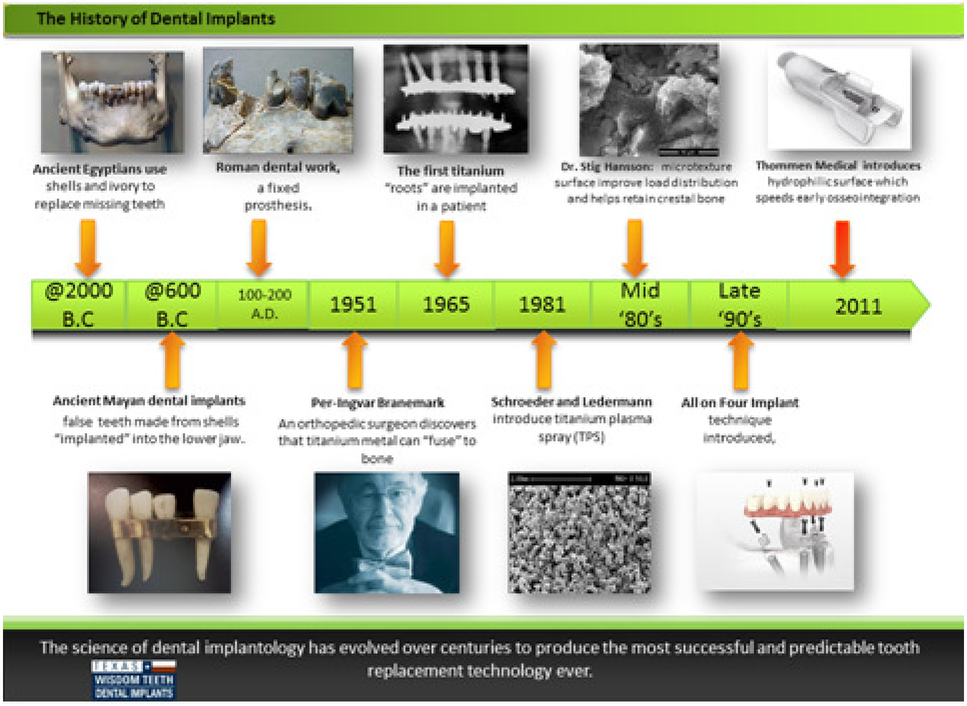
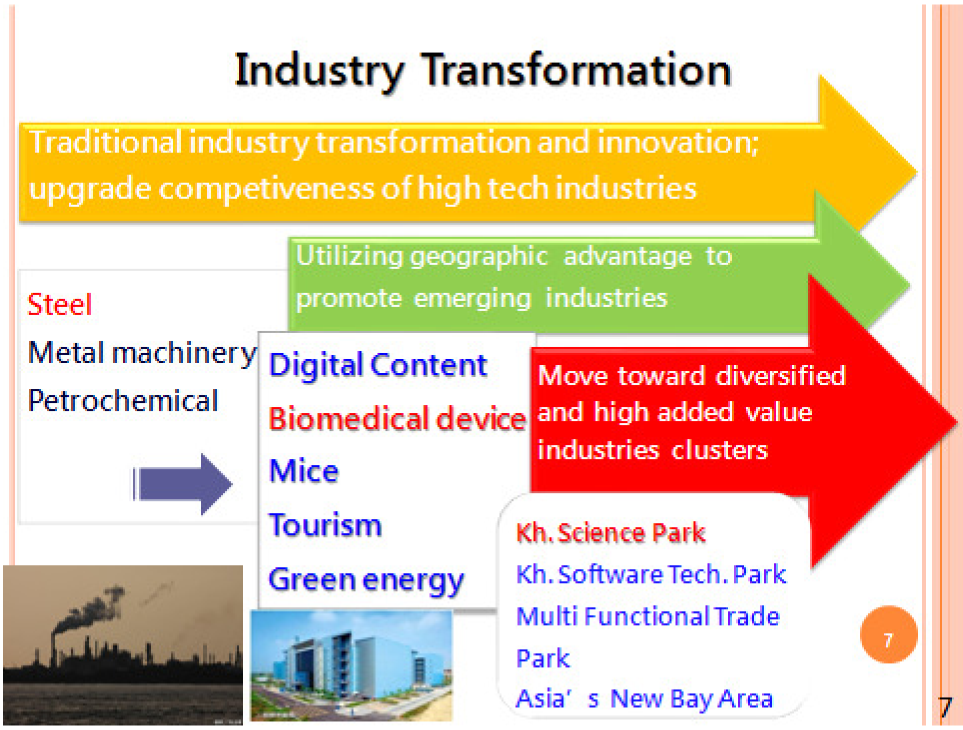


The History of Dental Implants
Ancient Egyptians use shells and ivory to replace missing teeth
Roman dental work, a fixed prosthesis.
The first titanium "roots" are implanted in a patient
Dr. Stig Hansson: microtexture surface improve load distribution and helps retain crestal bone
Thommen Medical introduces hydrophilic surface which speeds early osseointegration
@2000 B.C
@600 B.C
100-200 A.D.
1951
1965
1981
Mid '80's
Late '90's
2011
Ancient Mayan dental implants false teeth made from shells "implanted" into the lower jaw.
Per-Ingvar Branemark An orthopedic surgeon discovers that titanium metal can "fuse" to bone
Schroeder and Ledermann introduce titanium plasma spray (TPS)
All on Four Implant technique introduced,
The science of dental implantology has evolved over centuries to produce the most successful and predictable tooth replacement technology ever.
TEXAS WISDOM TEETH DENTAL IMPLANTS



Industry Transformation
Traditional industry transformation and innovation; upgrade competiveness of high tech industries
Utilizing geographic advantage to promote emerging industries
Steel
Metal machinery
Petrochemical
Digital Content
Biomedical device
Mice
Tourism
Green energy
Move toward diversified and high added value industries clusters
Kh. Science Park
Kh. Software Tech. Park
Multi Functional Trade Park
Asia' s New Bay Area
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KAOHSIUNG GAS EXPLOSION(2014/7/31)

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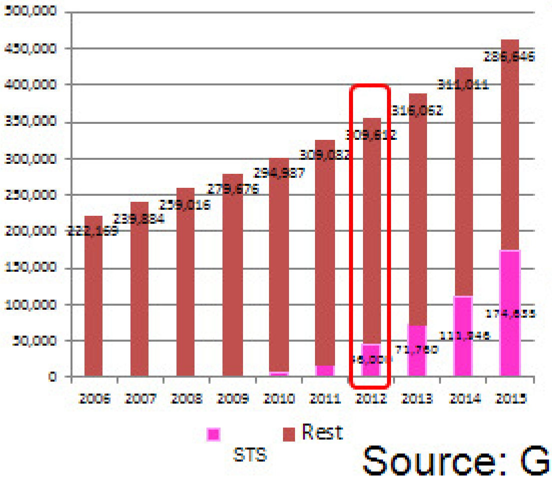
Since 2008 to promote the medical devices industry clusters

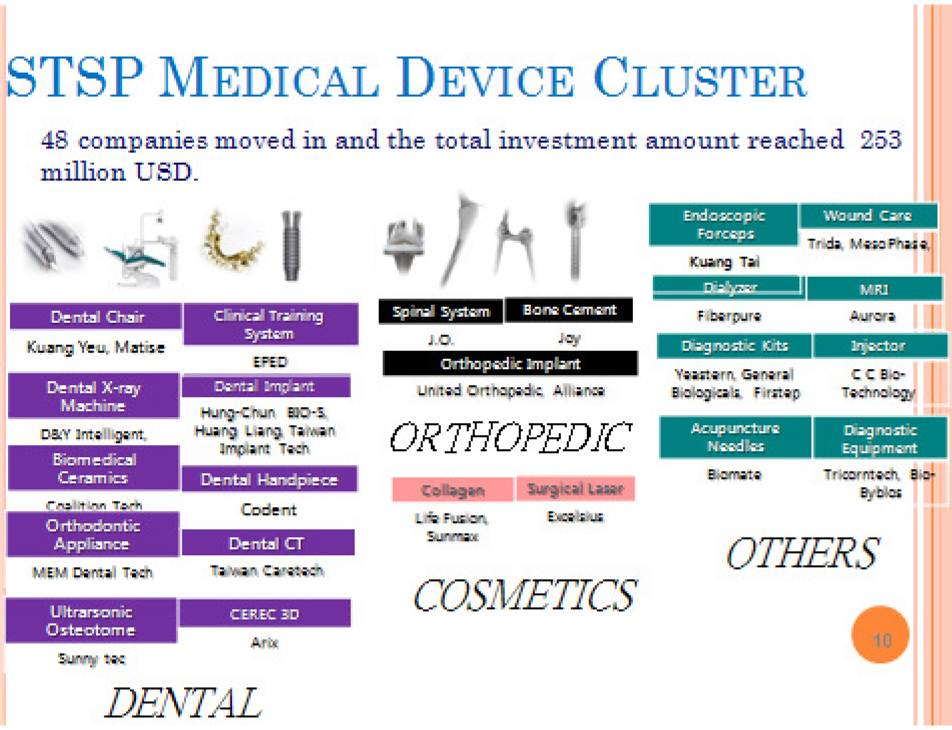
- 2013 Screws village transformed into medical villages

Replace imports



– Screw to the implant industry, industrial upgrading, productivity rose more than 400 times the value.
  - » 2012 import-substitution over 12% or more.
  - » 2010 began exporting dental implants

Source: Global Data


STSP Medical Device Cluster
48 companies moved in and the total investment amount reached 253 million USD.
Dental Chair
Kuang Yeu, Matise
Clinical Training System
EPED
Dental X-ray Machine
D&Y Intelligent,
Dental Implant
Hung-Chun BIO-S, Huang Liang, Taiwan Implant Tech
Biomedical Ceramics
Coalition Tech
Dental Handpiece
Codent
Orthodontic Appliance
MEM Dental Tech
Dental CT
Taiwan Caretech
Ultrarsonic Osteotome
Sunny tec
CEREC 3D
Arix
DENTAL
Spinal System
J.O.
Bone Cement
Joy
Orthopedic Implant
United Orthopedic, Alliance
ORTHOPEDIC
Collagen
Life Fusion, Sunmax
Surgical Laser
Excelsius
COSMETICS
Endoscopic Forceps
Kuang Tai
Wound Care
Trida, MesoPhase,
Dialyzer
Fiberpure
MRI
Aurora
Diagnostic Kits
Yeastern, General Biologicals, Firstep
Injector
C C Bio-Technology
Acupuncture Needles
Biomate
Diagnostic Equipment
Tricorntech, Bio-Byblos
OTHERS
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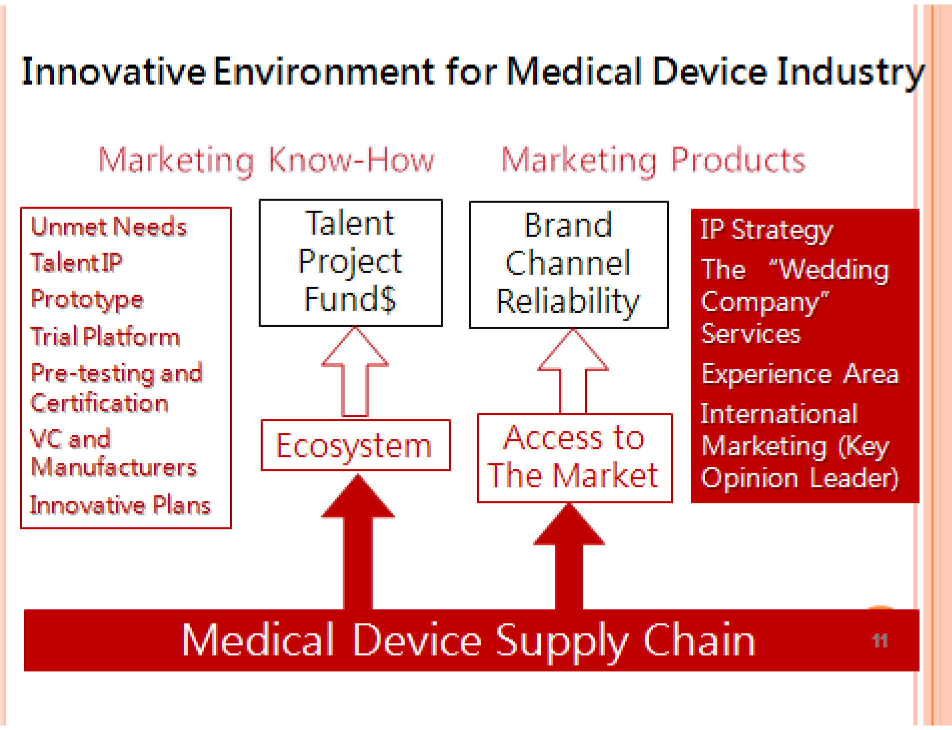
Innovative Environment for Medical Device Industry
Marketing Know-How
Marketing Products
Unmet Needs
Talent IP
Prototype
Trial Platform
Pre-testing and Certification
VC and Manufacturers
Innovative Plans
Talent
Project
Fund$
Ecosystem
Brand
Channel
Reliability
Access to The Market
IP Strategy
The "Wedding Company" Services
Experience Area
International Marketing (Key Opinion Leader)
Medical Device Supply Chain
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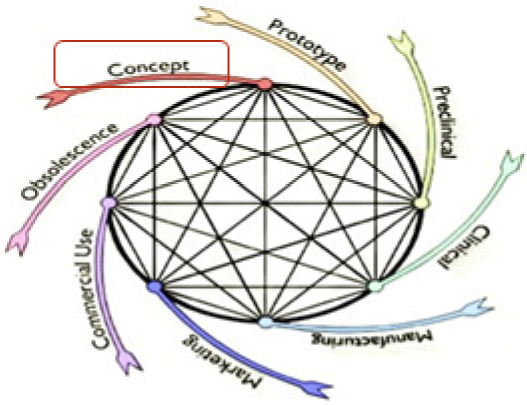
Medical Device Innovation



- *J Am Coll Cardiol Intv.* 2012;5(7):790-796.

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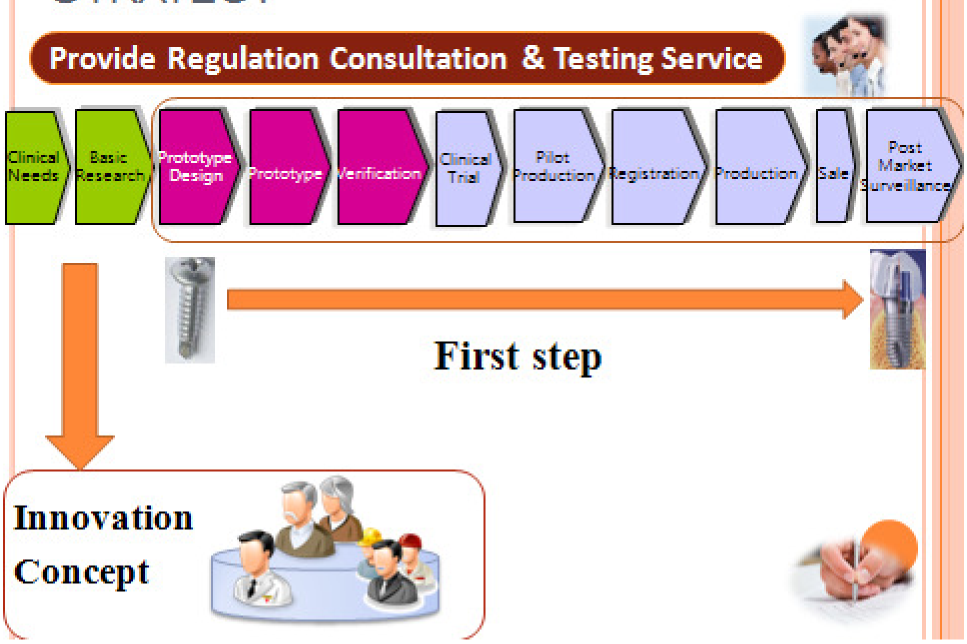
Industry Clusters Future Strategy



PROJECT TYPES

	Innovative	Individual	Cooperative
Contents	From IP to IPO From Bench to Bedside	Encourage the company to develop innovative technology or product	Encourage the company to cooperate with academia to develop innovative technology or product
Term	One year	Three years	Three years
Object	Company Academia (hospital) (university)	Company	Company and academia
Subsidize	<2.5 million NTD	<10 million NTD	<20 million NTD

Exchange rate：30NTD=1USD

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25 Cases Applied in 2013 with Nine Approved and the Successful Rate of 36%

Item	Name of Applicant	Name of Plan	Plan Type
1	National Chiayi University	Novel immunological sensing platform for spinal muscular atrophy and diabetes management	Photovoltaic monitoring systems
2	National Cheng Kung University	Development of medical devices for dental and oral/maxillofacial reconstruction surgery	Minimally invasive surgery applications
3	Chi Mei Medical Center	Wireless remote urine amount monitoring system	Photovoltaic monitoring systems
4	Precision Machinery Research Development Center	Single port scarless procedure kit	Minimally invasive surgery applications
5	Feng Chia University	Smart light-cured dental composite resins- preliminary evaluations before product commercialization in vivo	Photovoltaic monitoring systems
6	Kaohsiung Medical University	Bone substitute combined simvastatin carriers to promote bone growth of value-added research	Implant system
7	National Cheng Kung University	Development of Dynamic Spinal Stabilization System	Implant system
8	Industrial Technology Research Institute	High Frequency Oscillatory Ventilation Technology Development Plan	Medical imaging
9	**National Cheng Kung University**	**Robotic arm for CT scan-guided diagnosis and therapy**	**Medical imaging**

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MEDICAL EQUIPMENT

- Minimally invasive surgery
  - Single Incision Laparoscopic Surgery Procedure (Precision Machinery Research Development center)
  - Development of Medical devices For Dental and Oral/maxillofacial reconstruction surgery (National ching Kung University)
  - Endoscopic forceps (Industrial Technology Research Institute)
  - Screw Hole Targeting device For Fracture Intenral Fixation With Nail and Plate (Kaohsiung Medical University)
- Other eqipment
  - Infrared tomographic digital impression scanner (National Yang-ming University)
  - High Frequency Oscillatory Ventilation technology Development Project (Industrial Technology Research Institute)

MEDICAL IMPLANTS

- ORTHOPEDIC
  - Anibacterial stainless steel mini screw (National Taiwan University)
- DENTAL
  - Improving and stabilizing the production of synthetic bone restorative materials- the optimization processes of scaffold production (Feng Chia University)
  - Smart light-cured dental composite resins-preliminary evaluations (Feng Chia University)
- Other Implants
  - Develop a medical device for auto-fast isolation in MSCs (Kaohsiung Medical university)

Other Kinds Medical Devices(1)

- **In Vitro Diagnostic Devices**
  - Novel immunological sensing platform for spinal muscular atrophy and diabetes management (National Chiayi University)
  - Integrated Bacto Swabs system (Plastics Industry development center)
- **Telecare**
  - Development oF bowel sound detection algorithm and wireless instrumnet system (Chi Mei Medical center)
  - Wireless remote urine amount monitoring system (Chi Mei Medical center)

Other Kinds Medical Devices(2)

- **Guide and Measurement**
  - Robotic arm for CT scan-guided Diagnosis and therapy (National Cheng Kung University)
  - Developmnet of Novel Measurement Platform with Considerations of Axle Balance and Weight Distribution (Kaohsiung Medical University)
  - Bite Block system (Plastics Industry Development Center)
  - Upper Limbs Injury Treatment and Evaluation System (National Kaohsiung Marine University)
- **Biologically active ingredients**
  - Bone substitute combised simvastatin carriers to promote bone growth of value-added research (Kaohsiung Medical University)
  - Novel Wound dressing product Development (National Cheng kung University)

LEARNING BY DOING

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Thank you for your attention!!

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