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生命資本的理論與實踐

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中 文 摘 要 ： 本研究計畫以發展生命資本的概念來理解新興的生命經濟現象。生命經濟在歐美國家已經成為政策上的重要考量項目，成為各國推動未來社會經濟發展的主要方向，但其間可能的問題並未被確切分析過。本專題研究計畫即以生命資本的新概念來檢視其中可能的資本創造、積累與分配的現象與問題。

本計畫原設計以三年為期，並進行跨國比較研究。但因只接受一年期補助，故僅就學理、次級資料以及前期計畫的部份成果為素材，進行概念層次的討論分析，以回答原訂第一年的研究問題，即生命經濟與生命資本的關係界定，生命資本的內涵、以及生命資本的生產邏輯等。

生命經濟是一個新的場域，得與既有的社會切割出來，但亦受在地社會的條件作用。即如台灣與韓國各自有在地的網絡型態，台灣屬於轉譯型(translation)的社會，韓國屬於再生型(regeneration)的社會，而作用於其走向生命經濟的路徑。生命資本因此應具有三大形式，分別為治理性(governmentality)向度、經濟化(economization)向度，以及公共理解(public perception)向度。這三大向度分別開起在地與全球生命經濟的不同連接型態。

生命資本仰賴科技知識和經濟資本，但並不同等於這二者。生命資本是在新的生命經濟場域中編織出社會空間的條件。換言之，生命資本是生命經濟當中行動者之間可以區辨出相對位置的資源條件。藉由理解生命資本在生命經濟場域中的分配狀況，亦得以考察生命經濟反映出來的社會結構，並揭露其中可能的分配問題。

中文關鍵詞： 生命資本、生命經濟、生命價值、專利、場域

英 文 摘 要 ：

英文關鍵詞：

一、前言

晚近以生命科學(life science)及生物技術(biotechnology)作為投入，而生產出生命商品的經濟型態，或稱為生命經濟(bioeconomy)，已經成為先進國家致力發展的領域。例如經濟合作開發組織(OECD)在 2009 年提出了前瞻的 Bioeconomy 2030 願景報告書，在其中定義了廣義的生物經濟包括生物技術和農業。而美國 2012 年四月由白宮公告的《國家生命經濟藍圖》(National Bioeconomy Blueprint)則基於「生命經濟是以生物科學的研究和創新來開創經濟活動與公共利益」之理念，具體揭示了五大重要方向，包括健康、能源、農業、環境與知識分享等。這些具體的現象在在反映出生命經濟持續擴張的發展趨勢。

生命經濟是以生命相關之科技，如生命科學或生物技術等，用以創造產生出經濟價值。把生命經濟的起源向前推，可以推到 1950 年代，當華生等人發現 DNA 結構，對於生命的基本價值理念就開始了革命性的轉變。而二十一世紀之後一些重要的科技發展與經濟理念的變遷，更標誌著生命經濟的趨勢似已無法抵擋。即如人類基因組計畫(HGP)的草圖在 2001 年公開，就更進一步開啟了解開人體密碼的時代。然而生命經濟在後進國家的條件下，除了可能有分配、發展先後的問題，也會有其他意想不到的現象發生。由於生命價值的複雜，發展生命經濟也可能有許多不確定的因素，而不單純是經濟面的考量。若不能夠掌握到生命經濟的價值邏輯，非關的因素將深刻影響到實際上推動生命經濟的結果。即如投資於生命科學研究、發展生物技術、並推動生技產業已成為包括後進國家在內各個國家在經濟發展方面的重要的工作。各種不確定性因素的存在，也反映出新興的生命經濟有必要透過各種跨領域知識的討論予以釐清，方得確實掌握其運作之邏輯。因此，有必要進一步釐清生命經濟的相關現象與原理。

二、研究目的

基於對萌生中的生命經濟現象之以上說明，並其中可能對台灣乃至於全世界造成的衝擊，本計畫乃基於以下目的而提出。

1.為了發掘以生命為標的之經濟社會中，新的價值創造、生產、交換與累積之基本邏輯。

以生命為價值創造的標的，並透過生命相關之生產活動來形成使用與交換價值，是不同於過往資本主義經濟運作邏輯的現象，既有的知識並不足以用來充分描述與解釋，並且因此等現象產生之資本累積效果，也有待進一步理解。這些方面的基本運作邏輯，當對於新興之經濟社會形貌有相當重要之意義。

2.為了發展出一種可以判斷與評估生命經濟發展現象與程度，並進行相關比較研究時可操作之工具。

生命經濟若為各國政府推動經濟發展的重要途徑，其當有賴更確切可以描述、評估甚至解釋其中基本運作及效果的工具。而且，在愈加開放的全球經濟中，得以掌握這方面的整體性現象與發展程度的能力就愈加重要。

3.為了反省檢討當前推動生技產業發展之理念與作法，並更真切掌握未來相關生命科學與生物技術商品化之趨勢

當各國包括台灣都把生命經濟當成重要的發展課題來對待，生命經濟相關知識不足之處就顯得更為明顯。台灣推動生技產業已經超過三十年，但是一直以來還是找不到頭緒，也沒有具體的成果，反而在許多的紛擾之間，浪費了龐大的社會與經濟資源。這些攸關政策制訂與國家社會整體資源配置的研究，應當不亞於生命科學與生物技術的知識發展，甚至有過之而無不及。

4.為了貢獻於生命價值、生命經濟與生命政治等之本於社會學，但亦得以整合其他學科領域之知識進展

回到社會學本身的知識發展，本專題研究計畫亦希望能夠在跨領域及新興議題方面有積極的貢獻。生命經濟不僅牽涉到經濟學與社會學，也牽涉到科技、法律、倫理與社會的關係。另外，就社會學本身，經濟社會學、組織社會學、醫療與健康社會學等次領域也得因本研究有更進一步交流與擴張之可能性。

三、文獻探討

以下將就基本的生命經濟與生命資本相關議題進行文獻回顧討論。更特定與深入的文獻探討並將於本報告之結果部分，在已發表的論文中進一步討論。

1.從生命政治到生命經濟

根據傅柯的主張(Foucault, 1997)，生命政治是與生物或生命(bio)相關聯的權力觀點，是現代國家具有的，從主權統治轉換到治理性的一種政治現象，是在人口的層級上，而非個體層級上的一種觀點。在傅柯生命權力理論體系裡，生命政治原是一種與規訓權力相對的概念。傅柯認為十八世紀以前君王統治(souverain)的行使方式在「使人死、讓人活」(*faire mourir, laisser vivre*)，即其權力的積極效果是剝奪個人生存的權利，而讓人保存性命是是施恩的結果。相反地，現代的生命政治在於「使人活、讓人死」(*faire vivre, laisser mourir*)，也就是一種要盡力使人們的生命可以維持下去的權力運作，於是會技術性地介入原本個人可能會消極性地維護生存狀態、甚至做出放棄生命行為的私領域，而積極地防止個人對生命

保障之不作為或阻卻個人做出危害自己生命的行為。這種生命政治之概念，是為因應群體之「風險」(*risque*)、「危險」(*danger*)、和「危機」(*crise*)，以確保群體之「安全」(Foucault, 2004)。這些現象都是伴隨現代都市社會而生，也必須依賴現代科學工具之操作所產生的知識，做為解決因應之道，因此生命政治也是一種安全技術(technology of security)的表現。

傅柯對生命政治的一個重要主張是此一權力運作為的是整個族類的生存。因此，其乃連結到與繁衍後裔相關的人口議題(Foucault, 1994)。由於流動性是人口的基本屬性之一，生命政治也就具有流動性，而非固定不變。「流通性」(*circulation*)包括遷徙(*déplacement*)、交換(*échange*)、接觸(*contact*)、散播的形式(*forme de dispersion*)、及分配的形式(*forme de distribution*)等。從領土統治轉向人口治理是一個從個體到群體的權力基礎移轉過程，而配合著群體層級關於流通性的實證工具，作為治理技藝的正當基礎。亦即人口概念下對應的是人們的生老病死，而且是在集體層次上，故必仰賴統計學、人口學和流行病學之工具(Dean, 1999)。

有別於其繼承者聚焦於西方先進國家治理之論述，傅柯更多關心在「發展中」的社會(Rabinow and Rose, 2006)。發展中的生命政治具有使問題複雜化的趨勢，在人口相關的諸般現象之間有互動的關係，而不是獨立存在。例如疾病傳染與環境、人口密度、公共衛生相關，有時難以區分何者為先，或何者較為重要。在生命政治的討論中，個人不再是被關注的焦點，甚至有些個體反而是在關注整體現象的權力佈局(*économie de pouvoir*)被忽略，而無視於其存在。但誰有正當性來運作生命政治的權力，又是如何來行使這樣的治理技藝？論及治理的合理性就必須討論生命政治權威(biopolitical authorities)的概念(Nadesan, 2008)，也就是一種對生命治理具有正當性的權力，得以型塑人群（人口）中的實作(practices)和價值取向。這個有別於規訓的生命權力施為，使得生命政治從宏觀的人口治理，滲透到人們的日常生活層面。從生命政治到生命經濟，在治理術的理念下，結合成為一種新的自由主義下之權力進行式。形成中的權力不在於直接干預市場，而是透過建構市場環境的方式，干預到整體生命有關的事件(Lazzarato, 2005)。

在傅柯之後，一些政治哲學家持續為生命政治注入新的生命，在治理性(gouvernementalité)及各種現代社會中與生死有關的權力與統治議題上，有深入的討論與創見，也引起相當之迴響。例如對牲人(Homo sacer)與例外狀態的討論(Agamben, 1998; 2005)、社群與免疫典範(Esposito, 2010)、以及生產性(Hardt and Negri, 2000)的討論等，都饒富創意。這些持續性創作卻因此建立起不同於傅柯原本主張的生命政治理論體系。例如納格理(Antonio Negri)等人為了建構資本主義帝國體系的生產性討論，已經偏離了傅柯原本的意旨，反而造成對生命政治與生命權力的不同理解(Lemke, 2011:68)。而這些偏離對於理解生命政治與當前資本主義發展的關係，乃至於生命經濟的現象，或者是更具有啟發性的。

生命經濟不同於生技產業(biotech industry)

產業是屬於經濟場域的範疇，生技產業或與其他的場域之間有相互作用，但依舊是以第一類資本為場域中運作的基本條件。除了金融資本以外，生技產業是一個以生物技術為投入的產業部門，也就特別注重智慧財產權的保護（翁啟惠，2007）。但整體而言，在推動理念上仍屬於傳統產業經濟的範疇，受到既有經濟與生產邏輯的規範。雖然生物技術不同於其他產業部門的技術，產業發展所賴的條件也不一樣，但相關的論述仍是以經濟場域的運作邏輯來分析。在台灣的主流政策論述是基於生技產業的發展。這種論述從 1980 年代開始一直到二十一世紀不斷演變。投資於生命科學研究、發展生物技術、並推動生技產業已成為包括後進國家在內各個國家在經濟發展方面的重要的工作。這方面不乏精彩的社會學研究之作（如王振寰，2010）。

生命經濟不等於生技資本主義（bio-capitalism）

生技資本主義和生技產業是相對的一組討論。產業是以經濟為主體，以生產力或財貨為中心。資本主義則是以勞動為主體，以關懷勞動或人為中心的思考。將資本主義冠以 bio-字首，除了強調其以生技為生產技術的特徵，更在於與既有的資本主義有屬性上的差異。因此，生技資本主義就是特別針對生技產業所代表的經濟場域進行批判。從資本主義進入到生命資本主義，並非只有產業別的改變，而是牽涉到幾個更根本的變遷，包括價值生產模式、評價機制、以及資本的形式與分配方式的改變等（Sunder Rajan, 2006）。因此，生技資本主義是著重於對生技產業中新的勞動狀態及所得分配現象的關懷。

從全球化下北南不均的批判觀點來看，對參與在生技資本主義中的南國可能有三方面的危害（王佳煌，2007）。其一，資源掠奪。北國盡其可能以南國為生物品種、人種、實驗田野等作為投入，再將產品販售回南國，取得利益。其二，技術壟斷。北國以法規制度限制技術知識的範疇，南國難以取得或使用。其三，不公平國際分工。南國雖然可以參與在生技資本主義的生產活動中，但侷限在附加價值低、環境衝擊高等事業範疇，付出的代價可能高於所得的利益。

2.生命資本的概念

對馬克思(1867)而言，資本是用以區別不同社會階級的重要概念。資本的累積造成了一個社會上少數人不需要付出勞動力，卻得以剝削其他大多數人的勞動力，使後者成為可以交易的商品，使人的勞動及其相關生存條件發生異化的現象。在《資本論》裡面，資本純粹就是指稱經濟資本，是資本主義社會中用以投入生產的財貨。馬克思的觀點影響了後續許多相關對於資本的研究與主張。

承繼經濟學與社會學對資本的討論，有許多不同的資本概念被發展出來，但其皆對應至某一種特定的資本主義類型。例如論及社會資本，已經是相當成熟的社會學概念，可用以處理社會中網絡關係與資源間的轉換現象(Lin, 2001)。又如 Bourdieu(1986)主張除了社會資本另有文化資本，也是具有相當濃厚社會學意味的概念工具。文化資本有三種形式，包括存在於個人內在的內含(embodied) 文化資本、以科技或工藝型態而物質性存在的具體(objectified) 文化資本、以及透過擁有證書執照被確認的制度(institutionalized)文化資本。文化資本可以透過再生產(reproduction)的機制形成社會壁壘，使得機會被封閉在特定的階級內。

然而社會資本與文化資本雖用以處理不同的場域規則，卻仍是在相同的資本主義邏輯運作下的現象。生命經濟之不同於過往之價值生產模式，在於其並非馬克思的勞動價值理論，而是基於生命價值理論(Morini & Fumagalli, 2010)。從勞動價值理論到生命價值理論不是突然間的現象，而是經過長期發展歷程。例如評價人的生命，如何可以從無價到可以訂出一個標準的價值，成為一種市場的現象(Zelizer, 1985)。又勞動的意義，如何可以從肉體的操作、到可被剝削的勞動力，一直到可以是為了有思想的生存活動(Arendt, 1958)。

傅柯將技術分為四類，包括外在於身體的生產技術(technology of production)符號系統技術(technology of symbolic system)，以及與身體有關的權力的技術和自我技術(technology of the self)，而具有與資本主義發展相互對應的時代變遷關係(Foucault, 1988)。傅柯在 1970 年代末期提出此一概念時，四種技術的互動或許還不是很明顯。但在 1980 年代以後，隨著新興科學技術的快速發展，已經深刻影響到人們之於醫藥與健康觀念的醫藥化(medicalization)現象，更進一步發展為對生物醫藥化(biomedicalization)，而從外在於身體進入到身體之中(Clarke et al., 2003)，使得生命權力的概念運用更為複雜。因此，生命資本之所以異於其他資本形式，在於其已經不再是如同生命權力所謂之人口調節或個人肉體的規訓，而是進入到肉體之內的細胞，甚至是在蛋白質分子、基因、甚至是象徵其意義的符號層次上(Helmreich, 2008)。但在另一方面，分子、基因、甚至訊息符號卻也仍然與人口的分群或種族相關連，並不能完全擺脫原本生命政治所欲處理的，與新自由主義之間的糾纏關係，反而變得更為複雜(Raman & Tutton, 2010)。而且這其中的複雜關係，會潛進到對於生命商品，例如醫藥法規的治理理念之內(Abraham & Ballinger, 2012)。

3.生命資本的內容

生命資本不是經濟資本。舉例而言，美國新英格蘭地區或矽谷一帶或有蓬勃發展的新創生技公司，主因於當地企業與學院關係密切，得有生技人才與技術知識之助，又有豐沛的資金挹注，可稱之為學院資本主義下的生技產業（曾瑞鈴 2009）。但這些企業的發展若是依靠股票上市上櫃，或經由大藥廠的併購來取得經濟價值，就不應該是生命經濟討論的範疇。這與「生命」或「生物」沒有直接關係，只是企業投資策略，與既有的資本主義運作沒有兩樣。這種創投的行動不應當被視為是生命經濟。生命經濟應當要配合生命科技相關的經濟活動而具體存在，而不是虛構在既有的金融資本主義運作裡面，成為企業間的金錢遊戲。因此，過往將投資在生技產業的資金稱為生技資本（biotech capital），應是屬於經濟資本的一環，是專指投資在生技產業發展的資金。這種資本投入的現象是屬於經濟場域的投資活動，不是生命資本。

從生命的物質化以及生命科技的經濟化來理解生命資本，本研究主張：

- **生命資本不是生技資本，但是需要新自由主義下資本的投入來養成**
- **生命資本不是智慧資本，但需要將生技知識商品化的能力**

生命權力應該要包括至少三個面向的考量：一種對生命真理的論述形式，及被認為是有能力論述該真理的權威；以生命及健康之名對集體存在進行干預的策略；以及主體化的模式，也就是個人能藉由上述這些條件進行自我的實踐(Rabinow & Rose 2006)。對照生命權力的運作，生命價值的產生亦當涵蓋三個層次的活動，即知識與權力、得有策略能力之機構或組織、以及某種可以建立價值標準的機制。Sunder Rajan (2006)提出的三個層面之生命資本：新的科學技術能力之持續推出、廠商的聲譽與地位之穩固與提升、以及對於商品價值的評鑑條件之確立等，在這裡是可以得到呼應的。故而由此重新定義的生命經濟就是建立在新的生命科學或生物技術基礎上，以增益人類生命價值的一種市場經濟類型。故其條件在於知識、認知與評價，也就是有科學或技術之基礎、與生命保障或增益有關、並且有可以交易的生命商品。以下將分別針對知識層次、組織層次、以及市場層次的相關文獻進行評析。

(1)知識層次

工具層次的資本內容包括技術的專屬性，例如專利智慧財產權以及可以建立起技術門檻的系統整合能力等。專利在不同的產業技術部門有不同的意義。過往的專利研究，尤其在經濟與社會方面，大部分偏重同質的社會網絡相互引用關係(如官逸人、熊瑞梅、林亦之, 2012)，台灣相關研究更多半集中在既有比較發達的產業領域。但晚近起源於技術建構的知識脈絡(例如 Pinch, Trevor & Bijker, 1987 和 Bijker, 1995 等)，卻強調異質網絡在專利建構中的重要性。專利與社會相

互之關係可以在三個層面上表現出來，一是在知識本身，也就是專利與學術期刊論文之關聯性，二是在組織或機構的層面上，專利可以是機構的工具，也會形塑機構的形貌，三則是在產業或社會整體層面上，可以因專利而得以辨視其特徵(Bowker, 1992)。

醫藥化學類的專利在發展出商品的過程中扮演著比電機或機械類更為重要的角色(Mansfield, 1986)。醫藥商品若無專利，將無法發展出來的比例高達百分之六十。反觀機械類商品僅百分之十五有專利之需要，電機類更僅有百分之四之需要。另根據中華民國科學技術年鑑所載，生命科學與生物技術相關領域的專利對於學術期刊論文的依賴度明顯高於其他各種領域的專利。從這裡可以發覺生命資本在技術與知識層面上，以專利來理解資本，可以產生不同於過往的特殊代表性意義。其一方面表現出資本的複雜知識密度，另一方面也反應出資本的多元價值屬性。

生技相關專利與過往其他專利的範圍與屬性差異甚大(Shimbo et al., 2004)。另外，專利的保護範圍界定從抽象的概念到具體可實踐的判準條件，包括舉證在專利訴訟中之重要性(Pottage, 2011)，在在顯示專利的價值並不是字面上可以呈現出來，而是需要建構的歷程。透過對專利的意義與功效之理解，進而產生新的發明，實乃一種社會建構式的概念產生過程(Cooper, 1991)。這種利益的發生並不是從發明推動而來，而是來自於專利利益的吸引所致。

(2)組織層次

過往有關生命經濟的分析(包括 Sunder Rajan, 2006)，通常會以公司規模、營運內容、研發策略、行銷策略、財務結構、經營所面臨的困難和風險、未來展望等，作為組織或機構層面的重要依據。因以跨國大廠為個案研究，看不出有何可以進一步發展之可能性。事實上，若結合新經濟社會學對組織的觀察，在組織層次上的資本則有如市場上的信號(signal)，用以象徵組織的地位(Podolny, 2005)，是組織可以被信任接受的基本條件。另外，組織間的彼此參照方式，也可以成為組織位置的重要依據(White, 1981)。

在生技技術發展相關組織方面，過往的研究也強調區域性的效果，尤其不同部門組織之間的關係在生技產業特別明顯(Audretsch & Stephan, 1996)。一些強調國家或區域創新系統研究，更是主張組織之間的互動模式對於生技發展有重要的作用。

(3)市場層次

生命資本可以反映出技術如何形塑社會經濟型態。過往相關文獻已經有類似主張，即技術物在社會中的使用與存在是具有政治性的，也就是會因此

決定社會中的權力圖像(Mumford, 1970; Winner, 1980)。而技術物除了具有政治性，更具有經濟性。但在過往科技與社會相關的討論中，多半著眼於其政治效果，而較少去分析經濟的意義。生命資本之所以會成為新的價值來源，也就在於社會中因此一技術知識之使用，建立起一套相應的價值模式。而另一方面，既有的社會權力條件也會形塑技術的使用狀態，即如疫苗採用過程中，不同國家的社會條件會決定出最終的使用型態(Mahoney, Lee & Yun, 2005; Blume, 2005; Blume & Zanders, 2006; Munira & Fritzen, 2007)。一旦技術物被採用，生命商品的交易秩序也就確定，市場即被建立。市場的條件也就是在這兩方之間發生。因此，所謂中程的市場概念，就是建立在一種具有鑲嵌性的社會關係上(Granovetter, 1985)，又如社會安全市場的網絡亦復如此(Baker, 1984)。

有鑑於生命商品的價值複雜(Rappuoli, Miller and Falkow, 2002;又如表 1-1 所列)，生命市場價值的確定依賴市場評價機制的確立就相當重要。事實上，市場之所以可以確立，晚近一些研究都指向一種具有展演性，是以理念驅動，而非自然形成的交易條件來理解(MacKenzie, 2006; Garcia-Parpet, 2007)，以致於市場必須要有建構的實體，或稱為市場的裝置(market devices)(Muniesa, Millo and Callon, 2007)。故而市場層次的資本當是對於前述工具及組織層次的表現，在社會中具有可以予以評價的條件，使得生命商品可以獲得對應之經濟價值，也保障其正當性。此即一種針對商品品質的評價機制，使得交換價值可以歸屬於工具擁有者之組織，且市場得以因此穩定確立。

四、研究方法

由於原本計畫以三年規劃提出，但僅核准一年，故亦僅能就其中可供執行的部份提出說明，並揭示後續可能的研究進路，特別是與 103 年期的計畫銜接之特性。原提案書中所遇進行在二、三年的跨國比較，因經費未核定，無法進行研究。但基於先前研究結果，仍略加考量。根據原本計畫的安排，第一年的主要問題在於四個部分，用以回應生命經濟與生命資本興起之主題：

- 生命經濟的現象與概念的出現所處之技術、知識、經濟與社會條件。
  （此部分之解答即如「生命資本論」中所述，在幾個重要的趨勢下發生）。
- 生命資本與新的生命經濟之間的關係
  此即用以定義生命場域
- 生命資本的內涵：即如在 ISA 所發表的，三個維度
- 價值生產邏輯：以專利為例的討論

本結案報告即是針對所提問題之解決即衍生之發現來說明。其中主要分析進路與方法說明如下。

1.生命經濟場域概念的確認：

根據前言及相關文獻的討論，生命經濟雖然已經成為各國爭相發展的領域，但其概念及運作邏輯仍然有待進一步釐清，甚至在何謂生命經濟，在名詞本身就有值得進一步推敲之處。從現象及理論上來理解生命經濟場域、生命資本、以及相關的概念乃是本年度第一個工作。

生命場域的討論有其認識論(epistemology)與本體或存有論(ontology)的立場。對於市場或資本主義經濟中的社會現象分析，在社會學家裡面分成許多不同的流派，而有非常不一樣本體論基礎。其中經常被引用來理解社會結構與行動效果的視角有兩類，其一是基於結構化(structuration)，也就是在結構與行動雙元之間往返，以解釋結構與行動之間的相互作用；其二是以鑲嵌性(embeddedness)來解釋個體如何在結構效應下的能動性，是一種屬於中程(middle-range)的觀點。用生命資本來衡量生命經濟中的結構樣貌，這是源於布迪厄的概念。但要將這個框架用在生命經濟中，必須考量到幾個重要的條件。首先是這樣的資本場域有足夠的自主性，可以自社會中獨立出來，在場域中有獨特的運作邏輯。其次是有可以衡量的結構性特徵，也就是可以定義出資本的內容。而更關鍵且布迪厄尚未處理的，是在非法國的其他地方，如何在全球化的脈絡下來使用這個框架。是否可以把外部的條件隔離，單看本地的狀態？顯然不行。尤其對台灣而言，技術與市場都極依賴外部，難以自成一格來操作。

2.主要行動者界定：

基於在地發展的條件，本年度第二項工作在於界定場域的行動者。在台灣真正談生物或生命經濟的人物至少有三種類型。第一類是實際上投入在產業中的人士。這一類人士多半從美國帶著某些實務經驗回到台灣來開創新事業，也因此有著美式生物技術或生命科學的主流理念。第二類是商管經濟學者。由於台灣並未發展出如同西方可以被分析的產業經驗，這類學者也多以西方主流生物技術產業發展的模式來提供業界或政策諮詢。第三類是科技學者，以生命科學或生物技術的學院人士為代表。而政策推動者則往往在這三類人士之間流動，或受其影響。

3.知識與權力關係之勾勒：

過行動者之認知與其間關係之確認，可以建立起對於生命經濟的論述權力網絡。透過這個網絡的形貌，當可理解一個社會中，生命資本可以累積的條件。即如台灣或有相對成熟的生命商品使用條件，但生命資本的建構與積

累卻是相對難能發生。據此當能進一步發展出生命價值的生產、交換與積累之邏輯。

為了實現前述所提研究內容，這個年度的研究手段至少包括三個部份。第一個部份是從前一個專題研究計畫的跨國比較中，去重新耙梳出相關的現象，作為概念過渡與擴張之基礎。第二個部份在於透過更大量次級資料的分析，來理解生命經濟興起的諸般屬性。第三個部份則是進入在地的田野，透過相關行動者以各種方式自我陳述與彼此交流，建立起行動者之間的相互參照模式。

分析方法

理論發展：透過晚近針對生命經濟、生命價值與生命資本的文獻，結合過往社會學及相關學科的知識進展，進行生命資本的理論發展。

次級資料分析：大規模的生命經濟相關之文獻、報導、資料庫等，以網路、檔案資料庫搜尋等各種方式，建立相關之資料檔，進行關聯概念的分析。

五、結果與討論

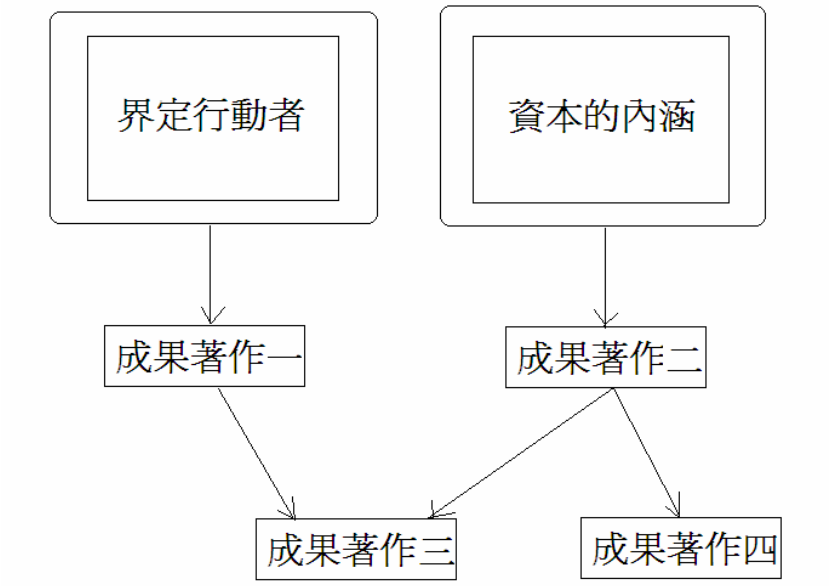
計畫期間主要的研究在處理生命經濟作為一個新興場域的核心問題，也就是意圖從一些可能的在地圖像來勾勒出此一場域的樣貌，並且發展出生命資本的內涵。主要的成果是以論文的方式呈現，如下表所列。

成果	主題	刊登或發表	狀態
一	**Global Technology and Local Society: Developing a Taiwanese and Korean Bioeconomy Through the Vaccine Industry** **(全球技術與在地社會：藉由疫苗產業發展台灣與韓國的生命經濟)**	EASTS (「東亞科技與社會」期刊)	即將刊登
二	**Developing Indicators for Biocapital in an Era of Bioeconomy** **(發展生命經濟時代的生命資本指標)**	國際社會學會 2014 年世界大會 (2014 年七月)	已發表
三	**生命經濟的起源、特徵與可能的分配問題**	2015 年台灣 STS 年會	已投稿
四	**國家與市場之間的技術論述：專利如何建構在地生命經濟**	2014 年台灣社會學年會	即將發表

根據原先研究設定，生命經濟場域的在地屬性必須先被設定下來。首先在在自主性的場域方面，有幾個重要面向是必須提出的，也就是在一些自發性機制中，確實可以看到生命場域的運作並不等同於一般社會的運作，有其獨特的運作邏輯，並且持續強化其自主性，而與一般的社會運作邏輯漸行漸遠。這是第一篇論文的主要貢獻，也就是提供一種特殊的在地社會網絡圖像，用以指出在地生命經濟場域的獨特性。

其次，在資本的內涵方面，本研究亦透過既有各種資本形式的啟發，並先前有關生命資本的研究，將可能的資本內容形式初步建構出來，即如成果二的論文所呈現。而且這樣的成果也正發展出可供衡量的指標，對於後續數量化的研究當有助益。這個部分如果能連結全球與在地，特別是東亞或台灣的在地性，如何在相同的架構下來分析。這部分可以連接到 EASTS 的論文，就其後續成果的發展，看出在地性與全球化的技術與治理關係。成果著作三就是這兩個成果集結的呈現，透過在地政策的分析，可以初步看出在地資本的累積狀態。

成果著作四則針對專利作為一種資本的內涵深入討論，以期揭露出在地與全球生命經濟接軌的獨特樣貌。將四份成果的關係連結起來，則有如下圖所示。



前述四篇論文是本年度計畫的主要成果，將於下文中更進一步介紹其內容。

成果著作一

全球技術與在地社會：藉由疫苗產業發展台灣與韓國的生命經濟

Global Technology and Local Society: Developing a Taiwanese and Korean Bioeconomy Through the Vaccine Industry

Abstract

This paper discusses approaches to forming a bioeconomy in Korea and Taiwan, and presents examples of vaccine industrialization in the context of a dual-structured global vaccine market. The dual structure includes high-priced vaccines manufactured by large companies that use advanced technology, and traditional low-cost vaccines. During the mid-1980s, both Taiwan and Korea engaged in industrializing hepatitis B vaccines, which were among the first high-priced vaccines in the world. However, the countries developed into different market structures during the past quarter-century. This study involved analyzing approaches to developing a bioeconomy in Korea and Taiwan by using a symmetrical approach that explained both the success and failure of technology in a society. We used networks as constructive elements of the bioeconomy to argue that 2 heterogeneous networks, production and adoption, were critical for constructing the local vaccine market and industry. Korea and Taiwan were characterized according to 2 network configurations: *regeneration* and *translation*, respectively. In Korea, the production network was formed before the adoption network. The production network regenerates vaccines to influence the adoption network. By contrast, the adoption network translates and defines the production network in Taiwan. It implies that, for vaccine technology learners such as Taiwan and Korea to developing the bioeconomy, a local society of translational or regenerative network configuration is as essential as the developmental state.

Keywords: bioeconomy, vaccine industry, production network, adoption network, Korea, Taiwan

The term *bioeconomy* emerged in the early twenty-first century as numerous countries used this term in their plans or blueprints for future developments. Bioeconomy refers to the industrialization of life sciences and biotechnology to create economic values that differ from those of the previous economy (Rose 2007; Birch and Tyfield 2013). Because of the potential wealth of a bioeconomy, newly industrialized countries such as Korea, Taiwan, Singapore and China have acted to upgrade to a new mode of economy (Waldby 2009; Salter 2011; Wong 2011). Industrializing biotechnology is not new to Taiwan and Korea. In the early 1980s, both Korea and Taiwan attempted to enter the vaccine industry by developing a new vaccine against hepatitis B. Particularly in Taiwan, a similar approach to establishing a semiconductor industry was implicated to create the vaccine industry, but ultimately failed. Conversely, the vaccine industry met with initial success in Korea, and, therefore, greater effort was exerted to develop a *bio-Korea*, a synonym for bioeconomy in Korea.

This paper describes how Taiwan and Korea developed the bioeconomy by

investigating the network configurations before and after industrializing the hepatitis B vaccine. Two arguments are presented in this paper. First, a local society in the form of networks is no less critical than the state during the development of a vaccine industry, even though this industry strongly depends on the state. Second, a vaccine market is constructed by at least two entangled networks that reflect social orders of the local society.

1 Vaccine Markets: Manufacturing and Purchasing Vaccines

Although vaccines are biomedical products, the vaccine industry is not necessarily part of a bioeconomy for several reasons. First, vaccine supply was not profit-oriented at first. Jenner's efforts in the late eighteenth century to promote cowpox to fight against smallpox and Calmette's long-term task in the early twentieth century on Bacillus Calmette-Guérin (BCG), vaccine against tuberculoses, were not for the purpose of making money. Second, traditional approaches to vaccine manufacturing have not been sufficiently effective to gain profits. The conditions for vaccine production did not meet the requirements of a modern industry. Finally, the rights for manufacturing vaccines were often open to the public. Intellectual property rights were not critical for vaccine manufacturers. For these reasons, most traditional vaccines were provided by government-owned institutes that could not survive without financial support. However, since the late 1990s, a couple of new vaccines, including vaccines against human papillomavirus and conjugated pneumococcal vaccines, have generated substantial profits for certain international pharmaceutical companies, such as GlaskoSmithKline (GSK), Merck Sharpe and Dohme (MSD), and Sanofi Pasteur. The new vaccines of these companies are protected by intellectual property rights, allowing them to monopolize the market.

Vaccines are tools of governmentality in a modern society (Foucault 2004). In other words, vaccines are frequently distributed by government authorities to a population for the purpose of social security. Without the intervention of the government, healthy people would not accept the vaccines. The state is therefore a critical factor in vaccine administration (Colgrove 2006). State-centered frameworks, such as a *developmental state*, seem to be useful in discussing the cases of vaccines and vaccination in Korea and Taiwan. The developmental state framework emphasizes the critical role of government authorities during the economic development of a state (Johnson 1982). Intervening actions executed by the state can include extensive regulation and planning. Additional advanced versions of a developmental state have appeared in studies on science and technology policy making (Greene 2008). As mentioned, Taiwan and Korea attempted to enter the vaccine industry in the early 1980s. During that time, the two societies remained in martial law regimes, in which the states were strong enough to promote development, known as authoritarian development. Various achievements in public health have been made in the era, as can be explained by the developmental state framework (Wong 2004).

However, industrial structures of vaccine production in Taiwan and Korea differed in the early twenty-first century. Approximately 10 vaccine manufacturers exist in Korea, producing various vaccines. However, in Taiwan, only one human vaccine producer exists, producing only two types of vaccine. Moreover, regarding vaccines included in national immunization programs, the prices of exported vaccines are lower in Taiwan than in Korea. The different patterns in Taiwan and Korea might

be due to the state's actions, which can be explained by the developmental state perspective. However, to describe the market structure by merely emphasizing the role of the state is unsatisfactory. The state as a common factor can explain the varying results yielded by the different actions of the state; however, it cannot explain varying results yielded by similar actions, such as those executed by Korea and Taiwan. A symmetrical approach that is capable of describing or explaining both successful and failed cases, with the same kind of elements of explanation, is required.

Because of unsatisfactory explanation given by the state- and society-centered perspectives, we need to investigate in the level of actors. Firms in Korea and Taiwan were well known for their strategies of "imitation to innovation" (Kim 1997). They imitated by acquiring technology from developed countries and innovated by modifying the technology to reduce manufacturing costs. This model proved to be successful in certain industrial sectors, such as the semiconductor and consumer electronics industries. The diffusion of knowledge from advanced countries to local firms forms a network that is characterized by its dynamics and flexibility. Therefore, to have a network perspective on industrialization of technology in a local society is heuristic.

The concept of a market as a form of network can facilitate understanding of the different approaches that Taiwan and Korea have adopted to form a bioeconomy. White (1981) argued that markets are networks. A market schedule is a group of firms positioned in a market space according to their performance. The order of the market can thus be observed through the relative positions of the firms. According to the definition outlined by White, firms observe responses from their clients to identify their own positions in a market schedule. These firms also develop or modify their strategies by observing the actions of other firms in the market schedule. White (1993) called this phenomenon "markets in a production network."

Following the new economic sociology, as that created by White (1993), a market can be defined as

> a social structure for exchange of rights, which enables people, firms and products to be evaluated and priced. This means that at least three actors are needed for a market to exist; at least one actor, on one side of the market, who is aware of at least two actors on the other side whose offers can be evaluated in relation to each other. (Aspers 2006: 427)

In other words, as shown in Fig.1, a basic structure thus defined includes an actor on the left side and two actors on the right side. Accordingly, using two types of networks to describe a vaccine market is reasonable: a production network consisting of at least two vaccine manufacturers and an adoption network connecting a potential buyer and at least one of the producers, as shown by the diagram in Fig. 2. In other words, the adoption network must have a portion in common with the production network. Therefore, prices of vaccines are determined by the interaction patterns between the two networks.

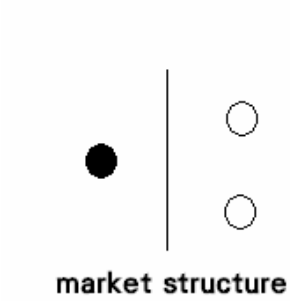


Fig. 1. A market of 2 sides

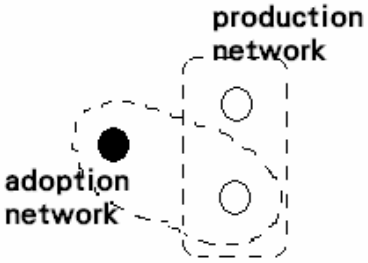


Fig. 2. A market of 2 networks

The production network of White consists of homogeneous members, the producers. Moreover, in White's thesis, the production network exists before the producers. To gain a symmetrical perspective on the market, the concept of networks at the ontological level must be modified. In other words, this research is based on relational ontology (Lin 2013). Compared with the structural viewpoint that a predetermined society exists, constructivists have argued that heterogeneous networks that join actors who present distinct interests regarding a common object are critical for establishing a society or for the process of reassembling a social world (Tarde 1890; Latour 1984;2005; Law 1987). This network perspective is also applicable to the description of technology diffusion among people and organizations (Callon 1991). A heterogeneous network consists of members that are not necessarily connected one by one. Rather, they are centered at an object along with their flexible interpretations or interests regarding the object. Compared with White's homogeneous network, actors of a heterogeneous network continue producing new structures instead of being framed by a predetermined market structure.

Although the concept of "network is known to STS readers, the network perspective proposed in this research was adapted from the domain of economic sociology, and may thus differ slightly from the concept with which STS readers are familiar with. Specifically, the perspective applied in this study is partly related to how social order is possible in a market, which is a major interest of economic sociologists (Aspers 2006; Beckert 2009). Keeping the constructive spirit in mind, a network is simultaneously a *collective* of actors (Latour 2005) and determinant of the local order among the actors. Moreover, the network perspective is a middle-range approach in economic sociology. Although the dimension of macrostructure does not appear in the network, the actions of network members can be influenced by structural effects, or even possess the characteristics of embeddedness (Granovetter 1985). Several structural concepts are derived from the network perspective, including structural holes (Burt 1992), status signals (Podolny 2005), and social capital (Bourdieu 1986). These concepts are structural constituents of a social space for economic life. Accordingly, markets can be categorized and classified by examining network configurations. Viewing networks from this perspective can assist STS readers to consider the network context.

Furthermore, STS scholars have considered markets as devices that realize economic rationality (Callon and Muniesa 2003). A perfect market can be constructed in purpose just by following economic theory (Garcia-Parpet 2007 [1986]). However, market processes do not merely involve economic considerations, particularly in cases where markets require classification according to local order among a group of actors who form a specific network. Thus, in this study, the production network was vaccine-centered, whereas the adoption network was disease-centered. The production

network can consist of heterogeneous actors, including vaccine manufacturers, technology suppliers, and financial supporters. They contribute to vaccine production. Members of the adoption network defined immunization action as preventing a disease by constructing a vaccination policy and acquiring vaccines. Among the members are few "truth-tellers" with the authority to justify the effectiveness of the vaccine policy. They are called truth-tellers because they dare to claim the vaccine's safety and effectiveness, or "truth," and are scientifically or institutionally trusted by other members of the network. The network is used for establishing health; in other words, to define the normal state of health. The actors can include government authorities, scientific or medical groups, associations, government officers, or a policy entrepreneur (Munira and Fritzen 2007). Even if a vaccine is manufactured by only one company, this network perspective is still workable. A case study on the vaccine against pneumococcal disease, namely Prevenar, indicated that even with only one vaccine manufacturer, the market can also be constructed by local networks (Chen 2014).

The relationship between the two networks can also be understood by considering transaction cost economics (TCE). TCE are useful in differentiating between organizations and markets (Williamson 1979). In the case of high transaction costs, an ideal strategy is to manufacture within an organization. Otherwise, buying in the market is a more efficient choice. Thus, deciding whether *to buy* (purchase) or *to make* (manufacture) also determines the relationship between the two networks. However, the adoption network involves more than the make/buy dichotomous decision of TCE. The network is constructive and evolves along with the dynamics of the network members, particularly with power relations among the members. From this perspective, the two networks function together to manufacture and purchase vaccines.

The adoption network and production network are equally crucial for a vaccine to be used in a society. A scenario in which an adoption network establishes a situation to define a vaccine preventable disease (VPD) is possible. Regarding the situation, a production network emerges to provide a new vaccine for the VPD. Another scenario is where a production network produces and defines a potential VPD for a new vaccine. An adoption network then recognizes the VPD and develops corresponding immunization programs that include the vaccine.

To discuss how the two networks coconstruct a market, this paper first describes the formation of networks regarding hepatitis B vaccines in Korea and Taiwan. Subsequently, the dynamics of the two networks in the two societies after the hepatitis B vaccine manufacturing became a mature industry in the late 1990s are discussed. This research was based on fieldwork conducted in Taiwan and Korea during the period of 2009–2013. Information on the production and adoption networks in the two societies were collected from in-depth interviews, archives, official documents, and media reports.

2 Network Formation: Hepatitis B Vaccine Production in the 1980s

Taiwan and Korea have similar historical backgrounds in the twentieth century. Both were Japanese colonies in the first half of the twentieth century. They had a strong alliance with the United States during the Cold War era following the colonial period. Known as the "Taiwan Miracle" and "Miracle on the Han River," they were also symbols of successful developing economies in the late twentieth century. Their relations with foreign countries and efforts in economic development were critical

factors for situations of immunization in the two societies. For example, BCG, the first vaccine against Tuberculosis, was first used in both Korea and Taiwan by the Japanese colonial government. However, BCG vaccines were not included in universal immunization programs of the two countries until interventions from international organizations in the 1950s (Joung and Ryoo 2013; Chang 2009). In addition, Taiwan and Korea used similar approaches for manufacturing Japanese encephalitis (JE) vaccines. They had technology transferred from Japan based on the Nakayama strain. Until 1980, and after aid from foreign countries or international organizations, domestically manufactured vaccines in Korea and Taiwan were provided by small-scaled public institutes, with low-ended technology, and for domestic use only.

The situations in Taiwan and Korea were not isolated because the global vaccine market was not sufficiently mature before 1980. Even in developed countries, most vaccine manufacturers remained small-scale compared with pharmaceutical companies. The first opportunity for the global vaccine industry was vaccines against hepatitis B, which were available by the end of the 1970s. Several vaccine manufacturers were competing fiercely for a new global market. Among the vaccine manufacturers were a U.S. company, Merck & Co., Inc., and a French company, Pasteur Vaccin, which became Sanofi Pasteur in the twenty-first century. Because Taiwan and Korea were severely threatened by hepatitis B, the new vaccine was an opportunity for them to protect their population as well as to join the global vaccine manufacturers. Because details of how Korea and Taiwan entered the industry and their results have been discussed elsewhere (Chen 2013a), the following description focuses on only certain facts directly related to the formation of the production and adoption networks in the two societies.

2.1 Korea's Approach to Entering the Hepatitis B Vaccine Industry

In the early 1980s, a group of World Health Organization (WHO) experts approached Korean companies, which were introduced by Korean-Americans, to inquire about the possibility of creating a manufacturing base locally to provide low-priced hepatitis B vaccines to the third world. They considered that large Korean business groups would be able to accomplish this task (Muraskin 1995). Their first target was Lee Byung-Chul, the founder and then-president of the Samsung Group. Through the foreign experts' efforts, Cheil Sugar, one of the group's subcompanies, became devoted to vaccine development and production. Cheil Sugar was created in 1953 as Lee's first manufacturing company after the Korean War. By using diversification strategies, several new business units were established from Cheil Sugar, which gradually became part of the Samsung Group. The foreign experts and a few Korean-American scientists helped Cheil Sugar to develop a plasma-derived hepatitis B vaccine during the mid-1980s.

When Cheil Sugar worked with the foreign experts, another Korean company was ready to launch another new hepatitis B vaccine. The company was Green Cross, a local Korean company that has been manufacturing plasma-derived products since the late 1960s. To obtain the vaccine technology, Green Cross recruited Korean scientists from the United States. Additionally, local vaccine experts, such as Dr. Kim Chung-Yong, provided technological support to the company. The efforts of Green Cross were also recognized by the foreign experts from the WHO.

With the help of the WHO experts, two plasma-derived vaccines, Hepavax-B by Green Cross and Hepaccine-B by Cheil Sugar, were produced in Korea and were

successfully licensed by international health organizations for universal use, particularly in third-world countries (Ryan 1987). Because of their low prices, the vaccines gained a large market share. The high vaccine sales worldwide generated large profits for the Korean vaccine manufacturers. The revenue of Green Cross doubled annually since the mid-1980s.

Successes in plasma-derived vaccines encouraged these companies to invest in developing recombinant DNA hepatitis B vaccines during the late 1980s. At the same time, LG Chemicals, a subcompany of the LG business group, sent scientists to the United States for training and to obtain the recombinant DNA vaccine technology. Strongly supported by the LG Group, LG Chemicals launched the first recombinant DNA vaccine, Euvax B, in 1992. In 1996, Green Cross also obtained technology transferred by a German company, Rhein Biotech, and developed the second Korean recombinant DNA vaccine, Hepavax-Gene. However, Cheil Sugar failed in the competition. The two recombinant DNA vaccines soon replaced the global market of plasma-derived vaccines and became the primary vaccine products of the Korean manufacturers.

The export-oriented vaccine industry strongly affected the Korean government. For example, to meet the regulations required for the global vaccine market, the Korean system of safety control on new drugs had to be upgraded. With direct aid from international organizations and succumbing to the pressure to export Korean vaccines to the third world, the Korean food and drug administration (FDA) system was established from a disqualified state to a state compatible with standards of the WHO in a considerably short period. In 1996, the Korean government created the Food and Drug Safety headquarters and reorganized it into the Korea Food and Drug Administration (KFDA) in 1998, parallel to the growth of the Korean vaccine companies and their global vaccine market share.

Another effect is that the Korean immunization programs depended on information provided by local vaccine manufacturers. Initially, strategies of universal vaccination against hepatitis B in Korea differed from those of Taiwan during the mid-1980s (Chen 2013a). The strategies were soon abandoned because of strong opposition from the medical community.

2.2 Taiwan’s Approach to Entering the Hepatitis B Vaccine Industry

Compared with the Korean approach in which the private sector was more active in developing the industrial technology, the vaccine industry was primarily promoted by the Taiwanese government in the early 1980s. The Taiwanese government launched a series of national programs to promote economic progress in the 1970s and 1980s. Among these programs, the most noteworthy program was a semiconductor program in which technology that was transferred from the United States successfully established the infrastructure of a local industry. Similar approaches were then implemented in other sectors, including the biotechnology industry. At the same time, hepatitis B was recognized as a severe disease spreading widely in Taiwanese society. To manage the disease, two Taiwanese teams conducted clinical trials of two plasma-derived vaccines that were to enter the market in the early 1980s. One team used a vaccine from Pasteur Vaccin, and the other used a vaccine from Merck. Their results were both highly impressive, according to reports of the trials (Liaw 2011). Thus, the government planned to develop the vaccine industry by acquiring the hepatitis B vaccine technology from one of the companies. If the capability of manufacturing the hepatitis B vaccine were established in Taiwan, not only would the

disease be effectively prevented by locally manufactured vaccines, but the vaccine industry would also be created following the successful model of the semiconductor industry.

The national program for hepatitis B immunization was initiated by the prime minister. In addition, the prime minister asked several ministries to join the program, including the National Science Council and Ministry of Health. This arrangement differed from that of the semiconductor program, which was primarily managed by the Ministry of Economic affairs. Some foreign experts, most of them in the domain of public health, were invited to offer advice regarding the technical part of the program. Additionally, local experts, such as Dr. Ding-Hsing Chen who was experienced in hepatitis research, were included in a national committee, established in 1982, to provide advice. Moreover, the government created a special unit, the Development Center for Biotechnology (DCB), to be in charge of vaccine industrialization under administration of the National Science Council.

Aided by the DCB, a new vaccine company, Lifeguard, was created to acquire vaccine technology from Pasteur Vaccin. Lifeguard was a government-financed company. The company was supposed to improve the capability of hepatitis B vaccine manufacturing. In 1983, Pasteur Vaccin successfully transferred the technology for the plasma-derived hepatitis B vaccine to Lifeguard. However, Lifeguard's new products had to pass safety and market tests. The safety test was an immense challenge to the government at the time; however, this vaccine was not intended for exportation. Regulatory conditions could be more flexible for urgent use in Taiwan. Moreover, because Taiwan was no longer a member of the WHO, the Taiwanese system of drug administration was not compatible with international standards. The status of Lifeguard was thus stabilized in the local market.

However, Lifeguard could not acquire the recombinant DNA vaccine technology from Pasteur Vaccin because the new technology conflicted with a patent of Smith-Kline. At the same time, new recombinant DNA hepatitis B vaccines from Merck were introduced in Taiwan. The new vaccines from Merck replaced the plasma-derived vaccine from Lifeguard. Without other products, Lifeguard could not survive. Partly because of its poor performance in the market and partly because the government lost trust in the company, Lifeguard declared dissolution in 1995.

2.3 Initial Patterns of the Networks

The network effects were substantial. The various modes of network formation in Taiwan and Korea caused contrasting configurations in the market structure. Aided by foreign experts, Korea established a self-sufficient supply system of hepatitis B vaccines. Although the vaccine supply system benefited from the global market, Korea failed in universal vaccination in the 1980s. Korea had to wait for a successful immunization result until a new vaccination campaign was launched in the early twenty-first century. By contrast, Taiwan completely depended on imported hepatitis B vaccines after the dissolution of Lifeguard in the early 1990s. However, Taiwan has achieved great success in immunizing the population through a series of immunization programs since the end of the 1980s.

The initial patterns of the Korean and Taiwanese networks are especially characterized by diversified and heterogeneous actors connected therein. Regarding Korea, the hepatitis B vaccine industry was constructed by strong interactions between the local private sector and foreign quasipublic actors, circumventing the Korean government. They formed a cross-border network for providing vaccine

supply to the third world. This network differed from that of the global vaccine manufacturers, such as Pasteur Vaccin and Merck. The Korean vaccine network can be regarded as a secondary market schedule that is beneath a primary market schedule consisting of leading international vaccine manufacturers. The secondary market was complementary to the primary market by meeting the quantitative demand of the third-world countries.

The Taiwanese vaccine industry was initiated according to a top-down approach, with a network centered at the government. However, the government consists of several functional departments and each ministry has its own concerns. Conflicts occasionally occur between departments. The hepatitis B program was created at the level of Executive Yuan, but Lifeguard was supervised by the DCB, under the administration of the National Science Council. The DCB was created as the Industrial Technology Research Institute (ITRI) in the semiconductor industry. They were intermediated between the public and private sectors, but they functioned differently in reality. Supervised by the Ministry of Economic Affairs, the ITRI was successfully integrated in the production network of the semiconductor industry. The ITRI not only helped transfer technology from foreign partners, but also provided human resources to the industry. However, the DCB is under the administration of the National Science Council, which is in charge of resource allocation for scientific research. Without direct connection with the Ministry of Economic Affairs (in charge of industry) or the Ministry of Health (in charge of the consumption), the position of the DCB in the production network was ambiguous.

3 Network Dynamics: After Hepatitis B Vaccines

The networks became established because the hepatitis B vaccine manufacturing, which developed into a mature industry in the late 1990s, continued influencing the vaccine market structure. Moreover, the networks were themselves in a dynamic state as power relations among the network members occasionally changed. This section discusses the production and adoption networks in Taiwan and Korea following the phase of the hepatitis B vaccine industrialization.

3.1 The Korean Production Network

“Clients of vaccine companies are governments,” stated a Korean vaccine industrial. Most Korean vaccine manufacturers agree with this statement. Although the Korean market is not sufficiently large, the Korean government is the most faithful client of local vaccine manufacturers. This is evidenced by the national immunization schedule in which the vaccines manufactured by Korean companies, including the Hib vaccine, are well accepted. A Korea Centers for Disease Control and Prevention (KCDC) officer insisted that for each vaccine included in the immunization program, there must be at least two suppliers of which one is a Korean company. It is also for this reason that in the mid-2000s, when the Korean government funded a substantial grant to develop an influenza vaccine, it went to Green Cross, rather than GSK. To ensure a local vaccine supply, the government is an essential shareholder of nearly every Korean vaccine company. For example, the Korean National Pension, a government-managed fund, holds approximately 8% of Green Cross shares. This fund also holds approximately 9% of LG Life Sciences shares, according to the company’s annual report.

The partnership between the Korean government and local vaccine

manufacturers exerts an effect on the marketing strategies of foreign companies. For example, in the product profile of Green Cross, several vaccines are manufactured by GSK, including Havrix, Priorix, Boostrix, and Cervarix. It seems that Green Cross has a closed relationship with GSK. This is because the large companies attempted to enter the Korean market by leading local vaccine companies that were positioned in "structural holes" between foreign companies and the Korean government. A structural hole brokers connections between otherwise disconnected segments in a network (Burt 1994). Additionally, Korean companies could work with the large companies by using a market alliance strategy. Therefore, they are working together to create the hole structure.

Korean vaccine companies can be categorized into two types. The first type manufactures products using their own brands. These companies, including Green Gross, LG Life Sciences, SK Chemicals, and Boryung, gain more profits from vaccine products than the second type. The major tasks of the second type are packing bulk materials for further distribution. These companies occasionally share their capacity with foreign vaccine companies as well as local companies of the first type.

Korean vaccine suppliers, particularly those of the first type, implement diversification strategies in products. For example, among the revenue of Green Cross, only approximately 30% derives from vaccine products. Moreover, vaccine products manufactured by Green Cross exhibit a percentage of approximately 17% of the total revenue of the company. Green Cross has a product profile that is sufficiently diversified. LG Life Sciences, an independent drug company separate from LG Chemicals and the LG group, presents a similar situation. Vaccine products exhibit a percentage of approximately 10% of the total revenue of LG Life Sciences.

Korean vaccine companies have strong liaisons with international health organizations. For example, Green Cross has a unit of more than 20 members in charge of international affairs. Among the members, some are regular staff who work in Europe, where the WHO and other chief international organizations in the field of vaccine and vaccination are based. As a top manager of Green Cross stated:

> Many people think technology to be the most important. For them, to have vaccine technology is enough. But it is not enough. The entrance barrier of the vaccine industry is not technology, but the long term relations with international organizations. (Interview record)

They also frequently interact with large vaccine companies, even though these large companies occasionally focus only on their own interconnections and ignore the secondary network. "It is very difficult to join in the network of big international vaccine companies," as a top manager of Green Cross stated. However, to be active in such types of contact remains helpful and necessary.

The production network in Korea is dynamic. The industrial actors compete with each other, whereas in certain situations, they work together as an alliance to share the local market. For example, although they compete with each other, Green Cross and LG Life Sciences coproduced the LG-DTaP vaccine to protect the market from foreign competitors. Another example is that Korean vaccine manufacturers share their redundant manufacturing capacity with others in need, particularly in the case of flu vaccines. Because flu vaccines are seasonal products, the filling capacity of vaccine firms can be used by other companies during the flu-free seasons.

The Korean government finances much application-oriented basic research in government-led research centers and universities. Top research centers, such as the

Korea Research Institute of Bioscience and Biotechnology and Korea Institute of Science and Technology, have research groups that are conducting application-oriented research. Additionally, a few venture firms have emerged since the early 2000s. However, their contributions to vaccine production are substantially limited. Results of the application-oriented research are still far away from being applicable in the vaccine market. Accordingly, the domestic vaccine market is dominated by expensive imported vaccines, such as those for human papillomavirus, pneumococcal, and other preventive vaccines (Kim et al. 2013) that cannot be produced in Korea.

3.2 The Korean Adoption Network

The Korean adoption network is characterized by the strong role of the KCDC. This organization was created in 2004, following the threat of SARS in 2003 (Cha 2012). Before 2003, the network was not yet centralized, even though several waves of national immunization programs were launched. Because discourses about vaccines and VPDs were segmented in the society, the network appeared to be a rather distributed configuration before the creation of KCDC. For example, the Korean Pediatric Association annually or biannually edited a vaccination guide for medical professionals since 1997. This guide, *Infectious Diseases and Control*, was supported by the Ministry of Health and Welfare, but dominated by the medical community. Korean vaccine manufacturers could also influence the vaccination programs, as they know more about the technical properties of the vaccines. The opinions of the medical professionals, the vaccine manufacturers, and the Ministry of Health and Welfare varied. For this reason, Korean immunization programs were not effective enough in the twentieth century (Lee and Choi 2008). However, the situations changed after the institutional reform in the early twenty-first century. A centralized governance structure has been established since the creation of KCDC. For example, the right to edit *Infectious Diseases and Control* was gradually dominated by the KCDC (Cho et al. 2010). For example, for the revised edition 2013, the KCDC just asks the medical association for opinions after editing is completed.

Technological advisories from the medical community can reach the KCDC through an expert group, the Korea Expert Committee on Immunization Practices (KECIP). This expert group consists of 15–17 members. Candidatures of the members are recommended by the medical community, particularly from professional associations such as the Korea Pediatric Association (Cho 2012). The KCDC elects and invites them to join the group. The philosophy of the KCDC is to maintain the rotating membership among the numerous local experts. Thus, each expert is supposed to be a member for only 2 years. Even the chair of the KECIP must change every 2 years.

In Korea, sometimes the medical community is less powerful than the government officers. A pediatrician described the mode of interaction with the Korean government as follows:

> They want to pass a rule. They just sent me a draft of the rule and gave me one or 2 days to check it. I did not have enough time to consider the rule in depth. But I have to answer them as soon as possible. We are not really respected with regard to our role in policy making. (Interview record)

To improve the interaction with the public domain, Korean experts created the

Korea Vaccine Society (KVS) in 2012. This association consists of members who are mostly active vaccine experts of the young generation in Korea (Cha 2012). They also launched an official journal, entitled *Clinical and Experimental Vaccine Research*, to be included in prestigious index databases of scientific journals, such as *PubMed* and *Science Citation Index*.

Some governmental actors have been invited to join the board of the KVS, including a KFDA officer in charge of vaccine control. Since the 2000s, the KFDA has engaged in connecting industrial actors with the medical community. Domestic vaccine producers have had good relations with the medical community because they need each other to achieve their respective ends: clinical trials and research. As promised by the director, the KFDA can further leverage the efforts of two sides to meet the standards at the global level (Kang 2013).

One explanation of the relatively high position of the KCDC in interacting with local experts is that the KCDC has direct connections with foreign health organizations, such as the WHO. Some KCDC staff members are also members of WHO committees. Thus, instead of working with local experts, the KCDC can also obtain legitimacy in establishing an immunization policy from direct connections with foreign authorities.

Another reason is the centrality characteristics of the Korean administration system. Recent evidence has shown that almost all governmental departments in charge of vaccine and vaccination policy moved to the Osong Health Technology Administration Complex in the early 2010s. Located approximately 100 km south of Seoul, Osong is a new town that was created to congregate national administration units in charge of biotech research and health affairs. This action shortens the physical distance between various governmental departments, such as that between the KCDC and KFDA. The action also widened the physical gap between the administrative departments and expert communities. Despite this gap, information technology ensures that communication between the government and experts remains unbroken. However, one of the most impressive observations reported in the literature is that the director of the KFDA's vaccine control unit has a hotline in his mobile phone to the director of the KCDC's vaccination affairs unit, implying that their direct and frequent interactions contribute to a very short social distance between the two most critical governmental actors in the adoption network.

Other government departments are potential members of the adoption network. "My boss is the Ministry of Finance," said a KCDC officer. Without financial support, vaccine adoption is impossible.

3.3 The Taiwanese Adoption Network

Since the 1980s, the hepatitis B immunization program in Taiwan has been praised as a success. The strongest evidence of this success is a series of long-term research results, which were analyzed and published as academic articles in top journals, determined by a group of Taiwanese pediatricians (Chang et al. 1997). These pediatricians were thus the most powerful "truth-tellers" about vaccinations in Taiwan. Accordingly, immunization policy making in Taiwan depended on the advice of local experts since implementing the hepatitis B program. It is also partly because of no official connection to international health organizations that the Taiwanese government requires the support of local experts for legitimacy.

Compared with the KCDC's authority in policy making, the Taiwanese CDC (TCDC) is strongly influenced by the local medical community. A formal expert

advisory system had been gradually established since the late 1980s and became the Advisory Committee on Immunization Practices (ACIP) at the turn of the twenty-first century. Members of the ACIP are elected by the minister of health and welfare from a list proposed by the TCDC. Although the system is institutionalized, a small group of experts has been part of the advisory board for more than 2 decades. Pediatricians, and particularly pediatricians of infectious diseases, are among the local experts who are most active in advising policy. As a TCDC officer stated:

> During the season of vaccinations, questions flux in from local public health stations. At that moment, we need Dr. Lee to help us. He is capable of providing us satisfactory responses to the questions. We can diffuse the responses to the public health stations to help the physicians and nurses standing on the frontline of immunization program.

A couple of pediatricians including Dr. Lee are the core members of the ACIP. Because of their seniority in the group and reputation in the medical community, even the director of the TCDC must maintain intimate relationships with them. Different from Korea where the director of KCDC is a position for senior civil servant, the director of TCDC used to be experienced physician from a prestigious medical school. Moreover, unlike the KCDC and KFDA—which are located far from Seoul—the TCDC is very close to National Taiwan University Hospital (NTUH). Medical experts at NTUH can even walk to attend ACIP meetings at the TCDC.

Some local experts are in the position of a structural hole between the adoption network and foreign authorities. These experts, such as Dr. Lee, have more opportunities to attend conferences held by international organizations and exchange information with foreign experts, compared with government officers.

From the viewpoint of resources, we can say that the Taiwanese adoption network basically comprises TCDC staff members and ACIP experts. Freely distributed vaccines in Taiwan are financed by a Vaccine Fund, which is the primary resource for national immunization programs. The Vaccine Fund is managed by the TCDC and monitored by the ACIP. The Law of Vaccine Fund was passed at the end of 2008 and has been in effect since 2010 for the purpose of securing a stable and independent resource for national immunization programs.

The core members also created an association for promoting vaccines and vaccinations. The association, namely Taiwan Immunization Vision and Strategy (TIVS), aims to diffuse information on vaccines and vaccinations throughout society. Although TIVS presents workshops for medical professionals, this association differs fundamentally from the KVS of Korea. The KVS provides more services to its members, mostly professionals interested in vaccines and vaccinations. The TIVS seems to be a medium for spreading accurate information to the general public.

Even though the ACIP is dominated by pediatricians of infectious diseases, it must expand its scope of expertise by including other medical professionals as members to manage the emergence of new vaccines. For example, gynecologists must be invited in the committee to offer advice on new vaccines against the human papillomavirus. However, pediatricians remain the most active experts in the field of vaccines and vaccinations.

3.4 The Taiwanese Production Network

In the early 1990s, the industrialization of vaccines against hepatitis B in Taiwan

failed when locally manufactured plasma-derived vaccines were replaced by imported recombinant DNA vaccines. The dissolution of Lifeguard left a void for local industrial actors in the production network. The void was later filled by local branches of large foreign vaccine manufacturers, including multinational companies such as GSK, MSD, and Sanofi Pasteur. The foreign companies were active in providing information on new vaccines to key actors of the adoption network. They even hired experienced pediatricians in their clinical units to facilitate communication with other actors of the adoption network. They also organized activities for local experts to meet and interact directly with foreign professionals. Scientific and technological activities like these are vital for these companies to establish a friendly environment to promote their new vaccines.

Compared with the diversification strategy of Korean vaccine companies, traditional Taiwanese vaccine companies manufactured vaccines only. One of the major causes of Lifeguard's failure was the company's strategy of manufacturing only one vaccine product. After Lifeguard, only one private vaccine supplier, Kuo Kwang Serum and Vaccine, existed in Taiwan. At the beginning of the twenty-first century, some small ventures interested in the vaccine business, such as United Biomedical, began emerging. However, these small venture companies did not yet produce their own vaccine product.

Kuo Kwang Serum and Vaccine was an animal vaccine producer. This company entered the human vaccine market by producing the JE vaccine in the 1970s, using technology acquired from Japan. Kuo Kwang Serum and Vaccine became the only JE vaccine supplier in the 1990s when the vaccine center of the TCDC stopped producing this vaccine. Subsequently, to enter the global market, Kuo Kwang Serum and Vaccine changed their company name to Adimmune. The title was selected following the strategy of ACER, a Taiwanese personal computer manufacturer that would always be at the top of alphabetized global company lists because its name begins with the letter "A." However, expanding the scale of the company was difficult. The turning point for Adimmune was in the mid-2000s when two former ministers of Health successively acquired the presidential position of the company. These former ministers were critical for engaging Adimmune in the production network. Because of their help, the Taiwanese government could invest in more than one-third of the company's shares.

Vaccine prices are lower in Taiwan than Korea. For the procurement processes of vaccines in Taiwan are price-based. As a top manager of Adimmune stated:

> In Taiwan, vaccine procurement must be transparent enough. The government just wants to buy the vaccines as cheap as possible. But the Taiwanese market is too small. The foreign companies can lower down their vaccine prices to gain the market. One million doses do not mean anything for them, as compared with their huge global market share. But for us, it is very difficult to balance our investments in manufacturing facilities, costs for clinical trials and other charges if we follow their prices. We cannot survive if we just look at the small market of Taiwan.

Adimmune's approach differs from that of the two types of Korean vaccine companies. First, Adimmune manufactures flu vaccines as its principal product. The company transformed from a packaging firm to a producer of flu vaccines. Second, Adimmune prefers the foreign market to the local market. For example, to meet the regulatory requirements of flu vaccine production, Adimmune stopped the production

line of JE vaccine in 2013. Adimmune's JE vaccine was manufactured by traditional method originated from Japan, which is not compatible to the quality control standards of modern vaccines. Without Adimmune's vaccines, the Taiwanese government was forced to import Korean JE vaccines urgently in 2013 and 2014. Replaced by Korean vaccine manufacturers, Adimmune's position is ambiguous in the production network.

3.5 A Comparison of the Network Dynamics

After the rise of Korea and fall of Taiwan regarding hepatitis B vaccine production, local networks of production and adoption have evolved markedly differently in the two societies. In addition, different modes of interaction between the production network and adoption network shape different forms of vaccine markets in Korea and Taiwan.

Korea and Taiwan exhibit several similar characteristics. For example, the expert group in the adoption networks, the KECIP and ACIP, are groups that exhibit a form consistent with that of advanced countries; however, their positions and functions differ in the adoption networks. Although the KCDC and TCDC are both cores of the adoption networks, they are observed to be dissimilar in their accessibility to international organizations or foreign experts. The adoption network requires the power of truth-telling as an authority of interpreting global technology, which varies in the case of Taiwan and Korea. The transferred technology can then be integrated in the local context in different manners. It can also be regarded as a process of "assemblage" (Chen 2012), depending on profiles of network members and their sequential orders of being assembled in the networks.

Regarding the Korean vaccine industry, the production network was constructed before the adoption network. Moreover, the adoption network is strongly influenced by the production network. The local production network in Korea, including the two types of vaccine manufacturers, still emphasizes manufacturing capacity, which was a tradition formed during the period of low-priced hepatitis B vaccines; a larger manufacturing scale means higher profits. Even the government focuses on the logic of price competition. The policy-makers are eager to see local companies enter a new vaccine market because it would lower vaccine prices. Accordingly, Korean companies have expended efforts to improve yields, reduce waste materials, and increase production efficiency. All of these efforts are manufacturing-based.

The case of Taiwan is opposite to that of Korea. The production network was created by the adoption network. After the failure of government action in industrialization, the local market connects directly to the global vaccine market and is more effective in shaping the adoption network by using external forces. The emergence of the local expert group was critical in connecting local networks with global technology. The status of this group in the adoption network is more stable in Taiwan than in Korea. Accordingly, imported vaccines are more preferable in Taiwan.

The production network that is more active in Korea is helpful to the vaccine industry. Sequential orders of network formation and the structures of vaccine governance are correlated in Taiwan and Korea. However, although Korea has developed the vaccine industry, the local industry is manufacturing-based rather than asset-based. Both Korea and Taiwan entered the new global vaccine market by manufacturing flu vaccines because of the large scale vaccine demand during specific seasons. They can compete with leading companies worldwide by the flu vaccines only because of their manufacturing technology and capacity, which can reduce costs.

4 Concluding Remark: Regenerating and Translating the Global Technology

The mainstream global vaccine industry is highly profit-oriented. Networks for constructing major vaccine markets can be effective and efficient. For example, local networks emerged soon after licensure of a new pneumococcal conjugate vaccine in France, resulting in substantial revenue gains for the vaccine producer (Chen 2014). In this case, the networks coordinated various values by performing "health" for the vaccine, thus constructing a local market for the global vaccine industry. Moreover, it is a monopoly market because the vaccine is well protected by intellectual property laws.

Dominated by large vaccine manufacturers, the high-priced global vaccine market is beyond the capabilities of Korean and Taiwanese companies. However, certain Korean companies have successfully reached the margin of high-priced side of the dual structure by their efforts in developing hepatitis B vaccines. Our study illustrates that, after the industrialization of hepatitis B vaccine, different network dynamics constructed different markets in Korea and Taiwan, even if the two societies are strongly influenced by the global technology and market. They have different patterns in connection with the global bioeconomy.

The state had influences on vaccine market construction. However, different from the developmental state perspective, the state participated in the networks by differentiating governmental agents and agencies into various roles. Taiwanese companies lost their advantages in manufacturing vaccines with the failure of producing hepatitis B vaccines in the 1980s. Although one reason is the lack of connection to global technology by the local firms, the effect of the state's isolation from international system of diseases control cannot be ignored. By contrast, Korean companies continued developing new vaccine products based on their manufacturing capability that was established with the success of the hepatitis B vaccines, which further drove Korean government to build up a modern system of immunization governance.

We can use two ideal functions to contrast the network configurations in Korea and Taiwan: regenerative and translational.[1] The network configurations are not direct outcomes of government action. Rather, the two types of configuration are outcomes of the collective actions of heterogeneous actors over several decades. The Korean networks exhibit a regenerative function in providing cheaper vaccines for local and international use. The Korean production network is sufficiently strong to adapt foreign technology and to manufacture vaccines locally. The regenerative function further modifies government actions of immunization on the population. The Taiwanese networks are characterized by their translational function because the initial configurations were established in the case of the hepatitis B vaccine. Network members acquired their power of action by collecting and analyzing data from long-term experience with local vaccinations. Universal vaccination programs, such as that for the hepatitis B vaccine, can be regarded as Phase 4 clinical trials, following three phases of trials before licensure of a new vaccine in the market. Accordingly, the

[1] These terms are taken from emerging fields of the biomedical domain. *Regenerative medicine* refers to a "process of replacing or regenerating human cells, tissues or organs to restore or establish normal function" (Mason and Dunnill 2008: 4). Stem cell therapy is a typical example of regenerative medicine. *Translational medicine* means to translate findings from medical and clinical research into diagnostic tools, medicines, procedures, policies, and education. Clinical trials are crucial aspects of translational medicine. The two fields are growing rapidly.

Taiwanese networks provide translational outcomes to legitimate immunization programs for various vaccines, without actively protecting domestic vaccine producers. Consequently, only a few domestic vaccine companies have not matured enough to be called a “vaccine industry” in Taiwan.

Constraint by their timing of accessing novel vaccine technologies, Korea and Taiwan continued to follow the approach of *from imitation to innovation* to enter the global bioeconomy. However, the bioeconomy has a set of diversified values that are not all accessible to imitators. As parts of the global vaccine industry, the regenerative and translational types of network represent distinct value orientations for local societies. The regenerative type seeks to exchange values by enforcing the production network, whereas the translational type is focused on use values that are defined by the adoption network. Although the Korean system follows the path of leading actors of the international vaccine industry to produce more exchange values, investment in research and development remains considerably low compared with world-leading vaccine producers (Kim et al. 2013). For the purpose of generating additional use values, the Taiwanese adoption network typically purchase vaccines with the lowest prices.

Explaining vaccine markets in Korea and Taiwan according to differences in network configuration implies that a local society is critical to developing bioeconomy. Different network configurations represent distinct modes of vaccine market, which is a combination of the two networks depicted in Fig. 2. As discussed in the paper, networks are not a naturally occurring phenomenon. Rather, they are historical and contingent outcomes of complex interactions among all entities, groups, and actors in the local society. Therefore, from the viewpoint of developing bioeconomy, we propose that Korea and Taiwan stand for two distinct types of local societies in accordance with their network configurations.

The cases of Taiwan and Korea further imply that developing biotechnology industry is not necessarily consistent with the development of bioeconomy. The perspective of developmental state may explain the efforts of Korean and Taiwanese governments put to developing biotechnology. However, without the perception of a specific network configuration that sets limitations on generating additional economic returns, policy-makers could make inappropriate decisions in promoting economic and industrial innovation for the next generation. Moreover, because the networks are always active, the configurations occasionally change. It implies that a new configuration will emerge once an alternative interpretation of the global technology is proposed by truth-tellers who gain power in the network dynamics. Evidence is that some Korean vaccine companies, such as Green Gross and LG life Sciences, have devoted to exploring new markets for cell therapies, whereas in Taiwan, medical service and translational medicine were chosen as major orientations for biotech industrialization in the national level. This difference further diverges their paths to a global bioeconomy.

成果著作二

發展生命經濟時代的生命資本指標

（已於 2014 年七月在國際社會學會 2014 年世界大會中發表。因準備投稿中，僅列出擴充摘要）

This paper aims to explore the frontier of developing indicators of biocapital, an emerging health-related notion with the rise of bio-technoscience. Different from other forms of capital, biocapital corresponds to a bioeconomy, in which biotechnology contributes to a large portion of economy. According to policy agenda proposed by OECD, elements of the bioeconomy include biotechnological knowledge, renewable biomass, and integration across applications, which are regarded as basic dimensions of the biocapital. As a concept *tout neuf*, biocapital is still too ambiguous to spread wide in the sociological community. However, it has been a trend for many countries to include the bioeconomy in their policy agenda, blueprints or visions for the coming decades. Like other forms of capitals, such as social, cultural, human, and symbolic capital, biocapital is useful for sociologists to observe resource distribution in a society. To cope with potential problems associated with its even distribution, it is necessary to make the biocapital measurable. Several obstacles prevent it being measured. First, it is a multi-leveled concept ranging from individual, organizational, societal to national level. Second, it contains networks of heterogeneous actors to realize bio-technoscience in the society. Third, it is a concept beyond borders, crossing state borders, market borders and disciplinary boundaries. The paper suggests several possible approaches for overcoming the obstacles. First, experiences of developing intellectual capital are inspiring, as the biocapital consists of the bio-technoscience. Second, also known as external control of organizations, a resource-dependant perspective of organizational study is heuristic for developing indicators associated with hetero-network such as firm size, number, networking configuration, etc. Third, the perspective of innovation system is useful for understanding holistic situation of biocapital. There are some other potential approaches such as that of cultural capital utilized by Bourdieu, as well as those utilized for indexing social capital.

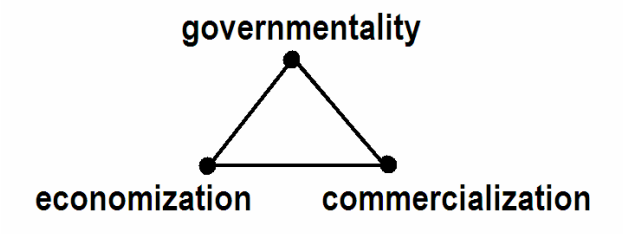


Figure 1: A triangular combination of biocapital

B(p, q, r) where p stands for degree of economization, q for degree of governmentality and r for degree of commercialization.

A perfect form of biocapital is B(1, 1, 1) which stands for a mature bioeconomy. We can define some ideal types of biocapital. An extreme case is that there is mere governmentality in biocapital. That is the biocapital have a form of B(0, 1, 0). It corresponds to the situation of pure biopolitics that neither economization nor commercialization of bioproduct is possible. The form of B(1, 0, 0) stands for economizing bioproducts only. This type of biocapital is for the big or leading enterprises, such as the big pharmaceutical companies. The form of B(0, 0, 1), opposite to the B(1, 0, 0), is consumption only.

Figure 2 is a two-dimensional diagram showing different combinations of p and q, without considering the situation of r. The upper-right quadrant approaching B(1, 1, r) is mature bioeconomy region. The upper-left quadrant, B(0, 1, r), is biopolitics region. The lower-right quadrant, B(1, 0, r), is bio-enterprises region. As to the lower-left quadrant, B(0, 0, r), it is the region where bioeconomy is underdeveloped. The classification according to Figure 2 is heuristic for countries making their innovation policies towards bioeconomy.

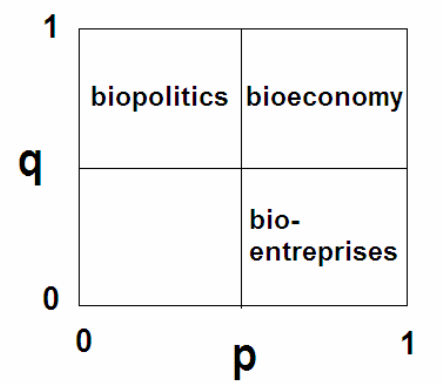


Figure 2: classification of bioeconomy by p and q

成果著作三

生命經濟的起源、特徵與可能的分配問題

（已投稿 2015 年台灣 STS 年會，僅列出摘要）

本論文在定義生命經濟(bioeconomy)、探討其起源、並就既有的現象以及學理檢討其特徵，並進而分析其可能造成的分配問題。生命經濟是晚近興起的一個概念，用以指稱因生命科學(life science)或生物技術(biotechnology)造成的新經濟模式。本論文透過跨國政策的比較分析來定義並理解生命經濟的起源問題。分析分為兩個層次，一是以 OECD、歐盟和美國為對象的前瞻政策議題分析，用以界定生命經濟的範疇；另一則是以若干率先提出生命經濟的國家，包括英、法、德、北歐國家、韓國與印度等，進行政策與在地社會關係之分析。生命經濟一詞在不同的國家和地區有不同的定義與內涵，相關的詞彙可以寫成 bioeconomy、bio-economy 或 bio-based economy，也經常被翻譯成生命經濟或生物經濟。這些用詞歧異不僅是字面認識上的差異，更反映出字詞背後的概念起源與詮釋理念。故此，生命經濟雖是全球化的現象，卻有在地的獨特樣貌，透過比較分析即能反映出在地的詮釋效果。建制生命經濟的政策網絡即代表著在地社會對於詮釋生命經濟的權力部署，也得以藉之理解相關資本條件的在地分配狀態。

透過政策的初步分析，本論文主張在高度生命經濟的體制內，生命政治(biopolitics)仍然是保障經濟活動的重要條件，但卻以更為隱匿的方式介入到個人的生命。這種過程體現在對生命意義的重新論述，或可稱之為後生命政治的現象。處於後生命政治中的生命經濟具有生命現象物質化、生命科技經濟化、生命價值標準化以及生命主體零碎化等特徵。這些特徵致使傳統的公民概念難以適用在生命經濟，生命經濟於是可以在既有的社會中切出自主的場域，在當中的行動者有其獨特的行動邏輯。在生命經濟場域中的資本分配未必與社會中的經濟資本分配樣貌一致，卻可能透過擁有不同形式的資本，也經由不同類型與數量的資源條件，以及差異懸殊的商品消費能力等方式，而以更極端的分配方式存在。因此，生命經濟不僅在科技與經濟方面與過往的經濟體制有顯著的差異，因其改變的社會生活樣貌以及倫理相關議題也都值得關注。台灣長期發展生技產業，卻一直未有所成，在生命經濟的討論也相對缺乏。實則要發展生技產業，除了技術與經濟，更應理解其間更具關鍵、卻更加隱匿的社會面向。而生命經濟的討論將有助於釐清發展生技產業的本質，對於台灣的生技產業迷思當有啟發之效。

成果著作四

國家與市場之間的技術論述：專利如何建構在地生命經濟

（即將於 2014 年台灣社會學年會發表，僅列出摘要）

生命經濟(bioeconomy)的運作核心在於規範生命資產(assets)的所有權，特別是保障智慧財產權的專利制度必須要能發揮功效。專利制度必須有國家專利相關法規的支援，並且透過由公部門提供的相關配套而得以維持運作。因此，生命經濟一方面是以專利作為資產，循既有的資本累積模式作為自由主義經濟的延續，另一方面卻藉由專利制度的維持使得國家有介入的正當性。換言之，生命經濟透過專利的存在，使得國家與市場可以連結起來。但專利制度並非一體適用、普世相通的制度，反而具有相當程度的在地屬性。目前大部分有關生命經濟中的專利研究，多以美國為主。在台灣方面，雖有少數研究，但仍未曾就專利如何在國家與市場之間建構出生命經濟有所考察。

本論文即以台灣生醫類專利的申請狀況及具有代表性的專利個案進行研究，透過專利的申請策略類型以及專利申請保護範圍的論述分析，用以揭露專利形成過程中的社會運作機制。透過對比台灣與美國專利資料庫中的同類專利申請狀況，包括年份與類別數量、發明人與申請人屬性分配等，可以看出台灣的生醫專利申請取向與美國的差異。更進一步在資料中分析，可以發現在台灣申請專利的三種基本策略類型。第一類是與美國醫藥廠商專利申請的相同策略：優先申請美國專利，再翻譯申請台灣專利。第二類是先申請台灣專利，再翻譯申請美國專利。第三類則以台灣專利為主，並不積極申請美國專利。這三類專利申請策略代表不同的國家與市場連結機制。

本論文主張專利的發生代表著以論述來實現多重利益的過程。雖然生醫專利通常是科研的成果展現，但其書寫風格非常不同於科學期刊論文。最大的差異在於專利是一種技術語言的轉譯，目的在將科研知識轉換為可以具體實現的可商品化、可被評價的狀態，並且在法律上保有可以被詮釋的彈性空間。此外，專利語言是制度與協商的展現。一般生醫專利是透過專利事務所申請，而專利權利則由智慧財產局授與。前者代表市場，後者則代表國家。更進一步而言，專利的撰寫是由專利事務所的專利工程師完成，專利之獲准公告則由智慧財產局的專利審查員決定。專利工程師（或專利代理人）與專利審查員分別代理主張個人利益和主張公共利益的兩造進行協商，最終產生可以公告的專利文本。

從專利文本的形成過程所連結的社會機制來看，第一類專利策略是在美國的主流生命經濟下運作，並透過專利文本的翻譯與轉譯，意圖形塑在台灣的生命經濟樣貌，使其與美式生命經濟相容，也就是將台灣也納入全球生命經濟的版圖。第二類專利策略是基於應用導向基礎研究的線性模式，即以專利為科研成果表現

的一種類型，再試圖將之擴散到可能的市場。第三類專利策略則將專利視為商業工具，專利可以增加產品的價值，其本身則不具有太大價值。國家的角色在這三類策略中明顯不同，或以被動角色牽引入全球生命經濟，或以主動角色定義在地生命經濟的範疇，甚或僅是最終的市場秩序維護者。故此，生命經濟一方面以跨國企業的積極作為，在自由主義下擴張全球版圖，另一方面也因國家在專利制度中的相對自主性，或可以產生在地的獨特樣貌。

其他成果

本專題研究計畫除了已經完成或即將完成以上學術論文發表或出版，也有其他具體成果展現。其中尤以協助兩位碩士兼任助理完成論文為最。其中一位以台灣 RU486 的生命政治為主題，探討在地社會於未及出生的生命治理之變遷意涵。另一位以醫療旅遊正當性的論述分析為題，剖析在地社會在於醫療旅遊的各種利益面向如何定義，並如何有諸般的論述交鋒。這兩篇論文的形成過程無論在概念架構的發展與資源條件上，多受益於本專題研究計畫，亦得視為衍生的學術成果。

六、結論與建議

生命資本的概念在 1980 年代末期就已經被提出了，但成為較廣泛被討論的議題，是要到 1990 年代中後期，尤其是基因技術與生命複製的技術快速突破之後，伴隨著生命倫理的議題成為潮流。但在台灣卻未見熱切的討論。這本身就是一個值得討論的問題。一方面，在台灣的生技產業向來就被視為「較不成功」的產業。相關的論述也多在將之視為某一類的科技產業，是以產業經濟或科技政策的角度來理解。另一方面，在全球化的生命經濟發展脈絡下，台灣新崛起的各領域專家成為各種生命商品的絕佳代言人，使得在地市場容易被建立起來。這種「雙元」的現象，使得「轉譯」型的在地生命經濟市場相對是明顯的。人們傾向去接受進口的生醫商品，而對在地的商品缺乏信心。

要去發展生命資本的概念，在台灣所處的條件下，有幾個重要的意義。首先，使得向來「不易成功」的主張或現象有一種解釋的可能。生命資本之不發達可視為一個重要的原因，是因為資本積累不足，使得生技產業及生命經濟都難有可觀

的結果。其次，生命資本的不均衡（勻）發展，因此造成在地的獨特現象，即「轉譯」型的網絡。（這部份何者為因、何者為果，仍有待確認）。再者，當前國內發展生技產業的樣貌亦得透過生命資本來檢討。即其輕國內重美國、或其他策略的考量，多得以生命資本的狀況得到理解，提供檢討之良機。最後，藉由生命資本的一般性條件，可以通盤反省，並以批判生命經濟可能之問題，得防患未然。在兩份論文中，揭諸生命資本的基本形式，其一是三維的組成元素，其二是就三維之一（專利）進行較深入之討論。這兩篇論文得提供不同於過往之於生命資本的討論，並能延續整個研究過渡到次一階段，使生命經濟社會結構之分析成為可能。

產業的形貌得以從生命資本的積累與分配狀態初步得到呼應。生命經濟因此也是產業關聯的。但除了產業的關懷，生命資本是更廣的、跨界的概念，涵蓋科研、法規、倫理以及關於人生終極的價值議題。如何讓生命資本具有在地化的效果，對場域施以地理界限是必要的。是這個隔離的作用，使得場域同時具有社會與實質空間的雙重意義。在布迪厄的作品中，雖然沒有談到空間的隔離，但他只談法國的情況，很自然地就把其他地方排除在外，使場域具有地性。故而場域一方面將自己與社會一般（general society）隔離出來，另一方面也將社會從全球脈絡中抽離出來。如此方能對場域進行實質分析。

當然在一些情況下，透過比較分析可以找到跨社會與跨地理的共通性，是場域與更大脈絡之間的相互滲透。但場域畢竟只是一個操作上的工具，是社會學家描述與解釋特定社會行動的科學工具，因此也就排除了可以直接觀察場域的可能性。倒是某些資本是具體可被量測甚至觀察的，而得以清楚呈現出社會結構中的相對位置來。生命場域即為此等條件下的產物，其一方面是全球化作用下的在地現象，又是深受在地社會影響的特定思維邏輯；另一方面卻又在場域中呈現出資本積累的獨特樣貌。

專利申請的模式可以看出在地的分裂性格，其亦為對於「專利」之認識論斷裂。亦即專利發明人或申請人其實在相當多的情況下並不明瞭專利的價值邏輯在生命領域並不同於其他領域，專利的作用有賴相關條件被建制（institutionalized）或被建構（constituted）之後，才能發揮實效，否則將僅止於過往在產業領域內的價值，無法創造出複合的（composite）的生命價值。專利在生命經濟中不只是專利，更是生命與身體的象徵性所有權。是在這樣的象徵所有與財產權的宣示下，所有人都象徵性地被專利收買，使身體成為可被交換生產出價值的工具（或物質原料）。表面上人們依舊擁有身體，但某些部分的主權其實已經被專利化了，成為買賣的對象，且其主權未必在自己手中，而是由廠商、政府和專家共同來決定，並最終由生醫商品（受專利保護的）的施為宣稱了真正的主權。

關於專利的建制(institution)或建構(construction)可再進一步研究，這是後續可以發展的方向。建制本身是非關個別專利，是在制度上的「完備」，使任何專利可以在所設定的條件中發生效果。建構則為個別專利而言，是行動者刻意去建構出專利的意義與價值來。這兩種條件都屬於生命資本的範疇，都是為了標誌物質性生命可以被財產化之目的。但建制是在群體或國家層面上的現象，包括專利法規、審查機制與標準、侵權訴訟或救濟、乃至於專利鑑價和國際互惠或訴訟等。建構屬於個別層級，是基於行動者策略性地建構利益網絡，而得使專利在利益聯盟間產生最大的價值。當然經濟價值仍是最終的考量，但其間仍有賴各種不同類型的價值浮現，最後方能使經濟價值有正當性。透過專利的解讀，可以看出在地專利（生命資本）積累的條件與狀態，也能掌握到特定專利（生命資本）的發生過程，對於生命經濟中的核心機制可以更進一步澄清。

綜合以上說明，本專題研究計畫已經取得初步成果，並且在重要發現部分，也連結到後續進行中的專題研究計畫 MOST103-2410-H-004-174-，持續往生命經濟的社會構造方向發展，期待能有更進一步的成果展現。

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科技部補助專題研究計畫出席國際學術會議心得報告

日期：103 年 10 月 10 日

計畫編號	MOST　102－2410－H－004－108－		
計畫名稱	生命資本的理論與實踐		
出國人員姓名	陳宗文	服務機構及職稱	國立政治大學社會學系副教授
會議時間	103 年 7 月 13 日至 103 年 7 月 19 日	會議地點	日本橫濱
會議名稱	(中文)國際社會學會 2014 年世界大會 (英文)ISA World Congress of Sociology 2014		
發表題目	(中文)為生命經濟時代發展的生命資本指標 (英文) Developing Indicators for Biocapital in an Era of Bioeconomy		

一、參加會議經過

國際社會學會（ISA）世界大會是每四年一次的社會學盛會，今年由日本主辦。大會因受前幾年東京附近的核災影響，原先不怎麼被看好。但在日本社會學會動員其他友會的強大動作之下，包括台灣社會學會亦強力支持，而有超過五千多名世界各地的社會學家出席與會，盛況空前。光是台灣地區就有一百多位與會者，是各國參與人數中名列前茅者。

會議安排在橫濱舉行。橫濱可以說是東京的衛星都市，與東京往返交通三十分鐘以內可及。這個城市開發甚早，並且也吸納了許多就業人口，總人口數超過三百萬，比台北市區還要多人。如果從國外要搭飛機到橫濱，可以從羽田機場進出，機場到橫濱也才三十分鐘，不必經過東京到成田機場。對於會議安排確實也是方便之處。

ISA 大會研討會場所在為橫濱港灣最大的會議中心 Pacifico，提供有兩處大型建物進行所有活動。會議地點與橫濱市區相鄰，附近也有許多大型旅館飯店，社會機能相當不錯。圖 1 是從地標大廈(Landmark Building)頂樓取景所見之的會議場地。照片中最高的建築是 Queen’s Tower，包括有三棟大樓，另靠海灣的帆船造

型的建築就是 Pacifico 會議中心的旅館區。會議所在是在 Queen's Tower 和帆船型建築中間橫向平行海灣的一整排建物之中。

圖 1：會議所在地 -- 橫濱的 Pacifico 國際展館及其附近建築

由於會議期程長達一週，而個人論文發表安排在星期二，故衡量公務所需並盡量參與會議之可能，乃於週一啟程前去與會，週六返回台灣。如此安排雖無法參加週日的開幕式和週一的議程，但仍能夠盡最大之可能全程參與會議。為了接待與會數千學者在一週以內陸續前來會場，大會在會場內常設有報到處，如圖 2 所示，並提供與會者各樣可能的協助。

圖 2：大會接待與註冊大廳之一景

個人因研究主題在生命資本的概念發展，過往較多與科技與社會（STS）的

學術社群互動，較無機會接觸到其他領域的社會學家，故此次利用大型研討會的機會，將觸角伸向其他可能的次領域，期待能有意外的收穫。經評估議題的屬性，而以「社會指標」(social indicators)的發展理念，完成社會資本指標化的預備工作，將論文投向 RC55，也就是最新的一個研究社群，在處理複雜社會指標與複合（composite）社會指標的論文組（panel），期待能有所交流。RC55 的議程全部安排在展館區的 53 號展場進行。展館區原是商展使用的場地，如圖 3 所示，經分隔，而供不同的 RC 進行論文發表討論之用。討論區的樣貌如圖 4、圖 5 所示。

圖 3：研討會場實際上是商展的展示館，分隔成各個討論室

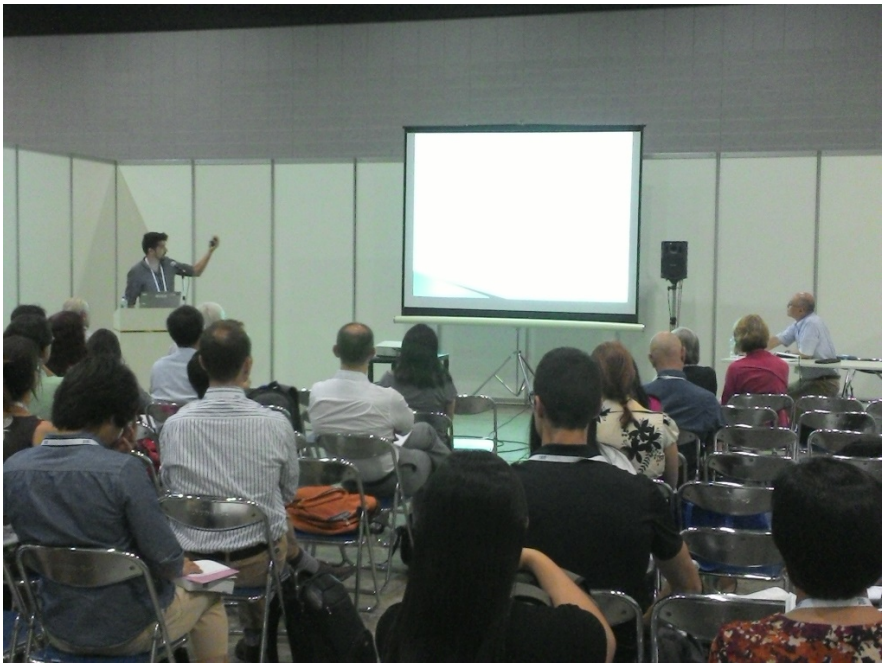
圖 4：RC55 發表會場內部

圖 5：RC55 發表會場外部

個人論文發表為週二上午，與西班牙、日本及荷蘭的學者同場交流。當時場內約有三十名聽眾，雖然時間短暫，但交流相當愉悅，議題的多元性豐富了現場空盪卻吵雜的議場（會議所在是商展場地，非常廣闊；但不同會場之間的隔音卻不甚良好）。

議程的安排相當緊湊。上千篇的論文必須在四五天內完成，同時間有數十篇論文發表在進行。因此，為了追逐自己有興趣的議題，得從一處移到另一處，席間也得中離，以捕捉某些特別有興趣的文章與議題。

圖 6：另一場論文發表會，是在 Pacifico 會議中心

二、與會心得

1.關於研討會的組織與運作。

舉辦一場可以讓五千多名參與者同時進行交流的會議並不容易，場地與時間的統整就是一大考驗。日本方面在這一次的投入算是 相當用心，尤其以橫濱地區的港灣為基地，讓與會者亦得以在足夠的時空彈性內達到各屬所需之目的。另ISA 原本就是一個由下而上的學會組織,大部份活動可以在各個學術次團體如 RC 和各國學會的絕對自主性下推動，亦得以見到相對多元的各樣學術活動。

除了正式的論文研討會，許多機構也利用空間與時間提供額外的交流機會。如台灣社會學會也在展場中擺設攤位，為國內的社會學發展現況向與會人士提供介紹。個人亦曾於其中與南非學者有所交流。

另外，特別在會議中籌組了台灣相關的論壇與晚會，讓台灣社會學得向世界展開。由於個人曾經在去年參與台灣社會學會，與韓國學會代表曾有接觸的機會，特別在此次日本的會議中與韓方的交流甚為熱絡，期盼後續能有更多可能的學術交流合作。

2.關於研究相關議題方面。

以此大膽將過往研究成果呈現在較陌生的學術次社群中，深有感觸。社會指標是一個工具性較強烈的次社群，雖然議題向外開放，任何與指標有關的論文都可以在其中發表，但在對話上，以既有的工具為基礎，並其所設定之「幸福」（happiness）指標為中心的潛在共識仍是非常強烈的。個人在報告前後感受到社群的友善，卻也同時發現彼此對話的隔閡。對話之難以發生主要在個人的論文尚未有實質資料的分析，未能觸及大部份社群中學者所關懷的指標建構工具，也就是從實際資料中建立起可供評估檢討的指標。是這個指標的操作過程才是更能引起人們關心的。另一方面，雖然生命資本的概念相當有趣，卻對與會者有一定的知識門檻，大部分與會者恐怕是第一次接觸到這個概念，並不容易在短短十幾分鐘內意會過來。個人在會議中最大的收穫是了解到後續建構指標可能遭遇到的實質問題。在生命經濟愈發重要的年代，如何能透過指標的呈現，提醒人們去注意到其中可能的問題，而未必是單向度地推動生命經濟，或者是在指標選擇與建構中更為重要的部份。

除了自己參加的 RC55 活動之外，個人也參與了其他 RC 的發表會。這些不同 RC 領域內的討論風格相當不同。例如在物質文化的部份，發表人用了相當華麗的投影資料來介紹其主張，但在同一場中，又有完全沒有投影資料，只有口頭

念稿的發表者，讓人見識到對「物質文化」的極端態度。另一場討論醫療化與全球化的會議中，主持人有絕對的權威在主導議程的進行。相當資深的主持人在整場會議中扮演「導師」(mentor)的角色，發表人則如博士生一般接受指正，宛若課堂專題研討之進行。雖然同屬社會學，但在不同的次領域中仍可見到相當不一樣的學術文化。這也是 ISA 引人入勝之處，是一個多元平台。

3.個人研究方面。

以生命資本的概念來尋求相關的回應，在本次會議中的迴響並不令人滿意。畢竟這仍是一個前沿且跨領域的主題，有待持續的耕耘。但此次會議仍有直接間接的受益，特別是在視野與工具方面。在視野方面，透過這次的會議中，各種不同的 RC 內豐富的議題，包括健康、醫療、組織與經濟、理論、物質文明、時間與社會等，讓我在發展生命資本的概念上有相當多元的想像空間。而東亞的日本、韓國、乃至於中國的獨特關懷，也提供我在思考現象的在地性方面，有了更深一層的領悟。在工具方面，特別是在 RC55 的議程中，許多論文提出的方法細節是過往不曾關注的，此次有幸可以跨界來學習，收穫良多。這次的大會雖然規模龐大，聚焦不易，但在其中似有不少至寶，個人領受的知識養分可謂豐足。

三、發表論文全文或摘要

此次發表之論文摘要如下：

This paper aims to explore the frontier of developing indicators of biocapital, an emerging health-related notion with the rise of bio-technoscience. Different from other forms of capital, biocapital corresponds to a bioeconomy, in which biotechnology contributes to a large portion of economy. According to policy agenda proposed by OECD, elements of the bioeconomy include biotechnological knowledge, renewable biomass, and integration across applications, which are regarded as basic dimensions of the biocapital. As a concept *tout neuf*, biocapital is still too ambiguous to spread wide in the sociological community. However, it has been a trend for many countries to include the bioeconomy in their policy agenda, blueprints or visions for the coming decades. Like other forms of capitals, such as social, cultural, human, and symbolic capital, biocapital is useful for sociologists to observe resource distribution in a society. To cope with potential problems associated with its even distribution, it is necessary to make the biocapital measurable. Several obstacles prevent it being measured. First, it is a multi-leveled concept ranging from individual, organizational, societal to national level. Second, it contains networks of heterogeneous actors to realize bio-technoscience in the society. Third, it is a concept beyond borders, crossing state borders, market borders and disciplinary boundaries. The paper suggests several possible approaches for overcoming

the obstacles. First, experiences of developing intellectual capital are inspiring, as the biocapital consists of the bio-technoscience. Second, also known as external control of organizations, a resource-dependant perspective of organizational study is heuristic for developing indicators associated with hetero-network such as firm size, number, networking configuration, etc. Third, the perspective of innovation system is useful for understanding holistic situation of biocapital. There are some other potential approaches such as that of cultural capital utilized by Bourdieu, as well as those utilized for indexing social capital.

四、建議

以下建議比較不是針對個人的研究，而是對於學界或學術研討會而論。

1.與會者眾，連結卻不足

此次台灣學者參與會議者眾多，但許多人都是獨自前往，雖有台灣論壇和學會設立的攤位，但真正參與者並不多。雖說社會學研究有相當的自主性，但以台灣之資源有限，如果未來能夠更多有團隊的方式參與這樣的會議，當可發揮更大的效益。

2.社會學次領域的凝聚

ISA 是一個比較由下而上的學會組織，各個 RC 的自主性很高。國內目前各類社會學研究，除了 STS、資訊社會學領域，其他次領域似乎較沒有一個草根式的連結關係。這方面的發展在未來也是值得思考之處。

五、攜回資料名稱及內容

1.大會議程手冊
2.各國社會學會資料
3.部分與會者聯絡資料
4.會議參與之筆記與影音檔案資料

六、其他

檢附發表會使用的投影資料：

XVIII ISA World Congress of Sociology
Yokohama, Japan, July 15, 2014

Developing Indicators for Biocapital in an Era of Bioeconomy

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Bioeconomy: a new form of capitalism

- A bioeconomy includes (OECD, 2009):
  - products and services from advanced biotechnological knowledge
  - renewable biomass and other processes for sustainable development
  - integration of applications across sectors
- A bioeconomy is asset-based economy (Birch & Tyfield, 2013)

Current situations of bioeconomy

- Policy priority (OECD, USA, European countries etc.)
- Distribution of resources
  - Health sector: investment (+), profit(-)
  - Industry sector: investment(-), profit(+)
- Indicators not yet developed

Potential problems with bioeconomy

- Wealth distribution
  - Games among rich countries
  - Small groups of participants
- Conflicts of different values
  - Economic values (use value, exchange value)
  - Social value
  - Scientific value
- Degeneration of human lives

Biocapital: possible indicator for bioeconomy

- Critical resources created, accumulated and distributed in a bioeconomy
  - Capability of actors to take action in a bioeconomy
  - Determinant of network configurations among the actors
  - Source of inequality in a bioeconomy
  - Structural element of a bioeconomy

Bourdieu's approach to capital

- Trinity: capital, field and habitus
- Various kinds of capital
  - Economic capital, social capital, cultural capital, symbolic capital
- Cultural capital
  - Embodied
  - Objectified
  - institutionalized

Basic dimensions of biocapital

- Economization (objectified)
  - Materialization of life, ownership of symbolic life
- Governmentality (instituitionalized)
  - Truth-telling: rationality of governing individual lives, normalization of life
- Public perception (embodied)
  - Diffusion of products and services of biotech applications in a society

Measurement of biocapital

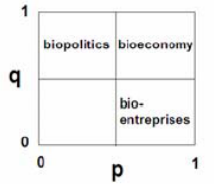
- 3 sets of sub-indicators
  - Economization
    - (Intellectual) property rights: Patent database
  - Governmentality
    - Truth-telling: policy network, academic publication
  - Public perception – embodied
    - Public acceptance: Big data analysis (among different languages)

Classification of bioeconomy by biocapital

Biocapital: B(p, q, r)

p: economization
q: governmentality
r: public perception

B(1, 0, 0): bio-colonization



Conclusion remarks

- Biocapital:
  - a composite indicator of bioeconomy from critical point of view
  - an indicator underdeveloped but necessary for developing the bioeconomy
- Challenges:
  - Skills for measuring and combining subjective and objective information
  - Weighting sub-indicators
  - Positioning bioeconomy in different societies

科技部補助計畫衍生研發成果推廣資料表

日期:2014/10/13

科技部補助計畫	計畫名稱: 生命資本的理論與實踐
	計畫主持人: 陳宗文
	計畫編號: 102-2410-H-004-108- 學門領域: 社會變遷與發展

無研發成果推廣資料

102 年度專題研究計畫研究成果彙整表

計畫主持人：陳宗文	計畫編號：102-2410-H-004-108-
計畫名稱：生命資本的理論與實踐	

成果項目			量化			單位	備註（質化說明：如數個計畫共同成果、成果列為該期刊之封面故事...等）
			實際已達成數（被接受或已發表）	預期總達成數(含實際已達成數)	本計畫實際貢獻百分比		
國內	論文著作	期刊論文	0	0	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	2	2	100%		
		專書	0	0	100%		
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（本國籍）	碩士生	4	4	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		
國外	論文著作	期刊論文	1	1	100%	篇	
		研究報告/技術報告	0	0	100%		
		研討會論文	1	1	100%		
		專書	0	0	100%	章/本	
	專利	申請中件數	0	0	100%	件	
		已獲得件數	0	0	100%		
	技術移轉	件數	0	0	100%	件	
		權利金	0	0	100%	千元	
	參與計畫人力（外國籍）	碩士生	0	0	100%	人次	
		博士生	0	0	100%		
		博士後研究員	0	0	100%		
		專任助理	0	0	100%		

其他成果 (無法以量化表達之成果如辦理學術活動、獲得獎項、重要國際合作、研究成果國際影響力及其他協助產業技術發展之具體效益事項等，請以文字敘述填列。)	除了論文發表，也透過參與國際研討會（韓國社會學年會、ISA 日本大會）連結國際社群，另有兩名碩士生受惠於本計畫順利畢業。

	成果項目	量化	名稱或內容性質簡述
科教處計畫加填項目	測驗工具(含質性與量性)	0	
	課程/模組	0	
	電腦及網路系統或工具	0	
	教材	0	
	舉辦之活動/競賽	0	
	研討會/工作坊	0	
	電子報、網站	0	
	計畫成果推廣之參與（閱聽）人數	0	

科技部補助專題研究計畫成果報告自評表

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

1. 請就研究內容與原計畫相符程度、達成預期目標情況作一綜合評估

■達成目標

□未達成目標（請說明，以 100 字為限）

□實驗失敗

□因故實驗中斷

□其他原因

說明：

2. 研究成果在學術期刊發表或申請專利等情形：

論文：■已發表 □未發表之文稿 □撰寫中 □無

專利：□已獲得 □申請中 ■無

技轉：□已技轉 □洽談中 ■無

其他：(以 100 字為限)

部分結果已經以論文形式發表於期刊 EASTS，亦於 ISA World Congres 2014 發表一篇研討會論文，另有論文即將發表於 2014 年台灣社會學會年會以及 2015 年 STS 年會。其他論文陸續投稿中。

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

本專題研究計畫按照第一年規劃，已經實質上達到應有成果，除了論文發表以外，也培養至少兩名碩士畢業生，並且透過參與國際研討會，連結到國外學術社群。