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Book Reviews

Science Business: The Promise, the Reality and the Future of Biotech

Gary Pisano

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Amgen, Genentech and Genzyme are successful biotech firms: who can dispute this? The market has endorsed their image and their substance as profitable companies, fuelled by pipelines of research that deliver rigorous science. They enjoy the support of public research institutions. Looking at these organizations, together with the biotech industry's positive public profile, one could be forgiven for taking the broader hype about biotech business seriously. For years, many people have seemed happy to believe that the biotech business and the business of science are getting along swimmingly. But Pisano says otherwise. With a few knock out punches, he outlines how average returns on invested R&D funds for the past three decades have failed to get much beyond zero in net income, even when sales started to soar in the early 1990s. Pisano tries to tell us where the problems lie and points to the need for fresh thinking.

This book is a look at the reasons for biotech's difficulties and its failure to deliver on hyped promises. It is focused on the market (rather than regulatory and institutional factors), the nature and life cycle of R&D and final commercialization within the pharmaceutical sector. Biotech is a classic tale of the schisms and challenges of mixing business with science. The verdict: biotech's business models are often not quite right for science-based-business and they can jeopardize the long-term prospects for sustainable funding. Some might say, told you so. Pisano meanwhile is concerned with where business and science can, and have, worked well together, and what is required to see this happen into the future.

Over recent decades, a progressive move towards private and public–private investment has crept into the processes that steer science (for better or worse) hence this tale is all the more apt and applicable across a range of disciplines, in both the market and the scientific community. Indeed, Pisano urges both sides, scientists and managers of business alike, and their various forms, to rise to the challenge of finding new solutions and configurations to solve the challenges faced by this sector.

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Pisano's book should have a broad appeal. It addresses the concerns of those managing science and knowledge-creation at various levels, from public institutions to the private sector, through to those attempting to manage, deal with or attract and convince the 'managers of science management'—i.e. those we usually call 'scientists'. It should also appeal to political advisers wanting to get a handle on this sector as well as the broader domain of science investment. In short, Pisano should attract the attention of biotech's students and researchers, through to its practitioners and those attempting to craft policies on and signals or guides within it. For the latter, this is a good, concise but also a comprehensive study of the key issues and their relevant historic moorings. Biotech's glistening glass and steel palace might be a symbol of scientific possibilities, but its business foundations are sometimes built on swampy ground—and collapse could undermine the associated science.

Pisano has no panacea. He does not explain how biotech's mix of science and business could by rote formula be placed on a solid footing. He does, however, methodically outline and deconstruct the challenges of getting biotech ideas to market: running the gauntlet to grasp the possibility of commercial success. But running the averages, it's best not to bet on the success of a single company in this sector: the odds are long. Like a turtle hatching from its egg, new ideas face many threats: it takes time to grow a hard shell and gain a modicum of market and IP protection. Predators abound and comparatively few good ideas grow to maturity.

We are given a 'walk through' of the lifecycle of bio-tech ideas, from inception to final phase-three trials and the regulatory approval of drugs. Pisano gives a potted history of the sector and its complexities. He reflects on biotech's multi-science foundations and technical diversity, ranging from genomics and computer modelling to combinatorial chemistry and high throughput screening. Meanwhile, the 'industrialization of R&D' in the 1990s has redefined the territory. In particular, the inception of the US$3 billion human genome project and its new blanket-bombing approach to mapping areas once worked on meticulously by the 'hand skilled bench scientist', ushered in a new era of 'high speed automation and the analysis of massive quantities of data'. This new territory has afforded opportunities to new, and more successful, companies such as Incyte and Celera: suddenly, it was possible to license 'inputs' into the drug discovery process, rather than engage in products or product development *per se*.

The tipping-points in biotech's evolution are tied to market perceptions. Technical considerations are often eclipsed by the market's belief in the dawn of a new era. When the market jumps to thinking that specific new breakthroughs or projects will quickly usher in a new era, the era arrives—possibly somewhat prematurely at times, and not always with a self-sustaining future. Consider the genome project as an example, when the market believed that revealing 'one-gene' diseases was the new Holy Grail, grail seekers abounded without regard to 'cold scientific realities' that would normally be sufficient to temper expectations. Pisano notes that the process of business information disclosure to the marketplace had improved by the time the industrialization phase was born, which has certainly assisted in speeding up some of the market correction processes, based on information and technical realities as they unfold. Without prescribing a panacea for how this can occur, Pisano puts information sharing at the core of delivering more effective market mechanisms for this sector.

But sharing information is not the same as meaningful communication. Pisano highlights the ongoing challenge of biotech's segmentation that divides scientific

fields of expertise creating linguistic and cultural barriers associated with this through to technical training processes and colleges or schools that further exacerbate the problems—which is an assuredly familiar theme to those who are familiar with the practice of science. And communication problems have profound financial implications. Luring the almighty dollar into the alchemist's den can breed its own form of oracular mystique. Market, institutions and public funds continue to 'bet' on the significance of science that they do not understand. Vast sums have been invested and more are committed. Flows of private and public money reflect faith in what might be produced. National Cancer Institutes worldwide are classic examples of optimistic expectations pushing large sums into places where venture capitalists might fear to tread.

When one stands back, and Pisano makes a good case for standing back, there should be a sense of wonder at biotech's spectacular achievements: screening for drugs; biotech collaborations, scientific and commercial; the human genome project (alone an amazing feat against time and catalysed significantly by private pushes into this domain) and the promise of whole new revolutions in pharmaceutical creation, from inception to production. But dazzling goals should not obscure the problems of poor communication and fragmentation. The effective use of resources requires coherent thinking across a range of different interest groups.

Pisano does hint at what is needed—and his audience might do well to heed the warning. Nothing less than a paradigm change, a revolution in business practices, will actually save this sector in the long term. Such conclusions have implications for the required overlap with the business community in other sectors of science, which, in the modern institutions of research and learning, are just about all current domains of hard science, even pure research. University research and other training organizations are not immune: business has breached the ivory towers.

Pisano's style is direct and business-like, which is what you would expect and desire from someone studying this sector. Science comes in many forms and the biotech sector was indeed a prime suitor for marriage to the business community. Yet, the marriage remains dysfunctional and without sufficient fecundity to boast a multitude of magnificent offspring. Where there are children that do stand out, and there are some brilliant examples, they confound and confuse: why can they not be cloned? But then the marriage is but yet one full generation long.

Perhaps the only lack in this book is sufficiently embellishing case studies and examples to highlight the points. Although the use of graphs, punctuated segments and concise précis of selected companies do go some way to satisfying, more (on the case study side) would be useful, and clearly Pisano would be the man to do this given his extensive and lengthy experience in this sector. From this reviewer's point of view, it would have been good to see a comprehensive, or at least an indicative, bibliography that would lead one on to greater heights and detail, particularly given this text is on one level a taster of the broader topic.

Pisano does not give the answers, and the field is too young, as he notes, to effectively explore the nature of the winners to date and how and why others may repeat their winning formulae. What he does do in this book is incite new thinking and new ways of looking at the issues facing us, with a challenge both to the scientific and business fraternities. Of course the challenges go way beyond these two groups, but finding ways in which both of these 'groups' can more effectively work together for mutually beneficial outcome is not only the age-old challenge of science in action, but is certainly at the core of whether the biotech future is

bright and brilliant or dull and distracted for many decades to come. One is left hoping for a sequel that does explore more deeply the nature of the winners to date, combined with a business blueprint that Pisano hints at that can guide this domain. No doubt, this will be an iterative and long-term process involving all sorts and styles and Pisano is bound to be a regular and noted narrator for some years to come.

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Competing on Analytics: The New Science of Winning

Thomas H. Davenport and Jeanne G. Harris

Boston, Harvard Business School Press, 2007, xv + 218 pp., $29.95, ISBN 13: 978-1-4221-0332-6 hbk

It's Science Jim, but Not as We Know It

Did you know that since they require neither cooking nor refrigeration, Strawberry Pop Tarts head Wal*mart's best-seller listings following hurricane warnings? In addition to sharing that little known fact, Thomas Davenport and Jeanne Harris's book *Competing on Analytics* claims to provide the first, comprehensive coverage of how to use 'analytics' to compete. Analytics are defined as 'the extensive use of data, statistical and quantitative analysis, explanatory and predictive models and fact-based management to drive decisions and actions' (p. 7). And the authors draw on a plethora of real-life examples to illustrate how analytic competitors use statistics, forecasting, extrapolation, predictive modelling and optimization to identify and exploit opportunities for competitive advantage, drawing on a sub-set of processes and techniques popularized within the 'Business Intelligence' domain. Though this data modelling of 'orientated-forward' business processes is an essential characteristic, analytics is not simply the use of analytical information technology (IT) tools, as the book takes pains to point out.

Structured into two parts, the first and major part of the book comprises five chapters devoted to the nature of analytic competition. In Chapter One, Davenport and Harris outline and contextualize their thesis. Analytic competitors use sophisticated data analyses to support a strategic, distinctive capability, for example in their supply chain or pricing strategies. In Chapter Two, four common attributes of analytic contribution are identified. As well as this distinctive capability, analytic competitors take an 'enterprise-wide' approach; their senior management are committed (a factor to which the authors lend particular weight) and are ready to take calculated risks based on analytic insight. This part of the book is replete with examples of mainly North American companies' adoption of these techniques. American Airlines' introduction of 'yield management' provides one early illustration. It is believed their seat price optimization technique not only netted them $1.2 billion in three years but also put competitors such as People Express out of business, a poignant illustration of how an analytic 'gamble' might pay off.

Five required factors for successfully linking an analytic capability to improved business performance are identified in Chapter Three. For a company to claim mastery of analytic competition, it must have an analytic capability that is: hard to duplicate; unique; adaptable to many situations; better than the competition; and renewable. Chapters Four and Five spell out how leading companies have used analytics to build and exploit distinctive analytic capabilities within their finance, manufacturing, human resource, and R&D functions. The authors explore the extent to which these techniques might usefully be adopted elsewhere. As you might expect, illustrations of the use of CRM-based analytics for sales and marketing sit alongside SCM procurement and logistics-focussed initiatives, demonstrating how the same techniques may be extended beyond the organization; though the authors identify particular limitations. In particular, the authors advise caution where data are limited or markets heavily regulated. Further, despite their early success with an analytic strategy, American Airlines' disappointing recent performance is attributed to two factors: firstly, their analytics support an obsolete business model; and, secondly, these same analytics are now standard across the industry. AA has lost its distinctiveness. Analytic benefits may be transient.

The second part of their book is described as a 'how to' guide. Davenport and Harris lay out a generic roadmap of the five key stages through which an 'analytically impaired' organization could expect to pass before achieving 'analytic competitor' status. Alternative 'full steam ahead' and 'prove it' paths are discussed, the latter for those senior managers of a more sceptical disposition. People and technological infrastructure are key resources and two chapters are devoted to outlining how they might be suitably developed. Finally, the future direction of analytic competition is sketched. For those contemplating this journey, the authors suggest that 18–36 months is needed before companies could expect to have the insights to translate into competitive practice. If this seems a long time, the authors speculate the full force of analytic competition will not be felt for another five years. This book certainly provides ample exemplars from selected companies already on the journey for you to read about whilst you wait. Indeed, the book is full of real-life exemplars of both internal and external analytic applications ranging from experimental site design at the data-rich Google to MCI's successful merger following the collapse of WorldCom.

Whilst the authors acknowledge that the academic research on analytic competition remains to be done, the central tenet of their book is an implied causality between the use of analytics and improved business performance (sorry if this sounds a bit technical, but this book is about the *science* of winning—so concentrate!) And they discuss some evidence to establish the link between analytic maturity and business performance, both investigations carried out by the Institute of High Performance Business, a branch of the consulting firm Accenture. In the first, small study, the 'analytic orientation' of 32 firms was rated and 20 of these companies' financial reports examined. The results show a small, statistically significant correlation (not causation, mind) between compound annual growth and competitive analytical maturity (subjectively assessed by the authors on a scale ranging from 'major challenges' to 'analytical mastery', described in Chapter Two). Five were judged to be fully-fledged analytic competitors: one was a dotcom, the others financial service providers. We are given no details of the basis upon which these 32 companies were selected. Meanwhile, a second study drew on an impressive body of 'longitudinal' survey data. This was a web-based survey of 450 executives from 371 companies, who had all invested in and implemented Enterprise Resource Planning

systems. Given the subject matter of the book, there are reasons to be cautious about the 'science' underpinning these analyses. Conventional scientists might sound warnings.

Beware of sampling bias. Without specifying either population or sampling frame, how can the results of two research studies: one of 'large' organizations and the other 'large and medium' organizations carried out over different sectors and industries be used to claim that 'companies' are becoming more analytical over time? They can't with any degree of confidence. Can you compete on analytics without investing and implementing at least two models of an ERP system? If the answer is yes, then whatever the results of this extensive survey, sampling error cannot be estimated with any confidence. *Beware of non-sampling bias.* Though Accenture have a standard measure of business performance, this was not used in the second survey. This makes any longitudinal comparison of results between 2002 with 2006 scientifically questionable. How was the web-based survey administered? We don't know. Volunteer and haphazard sampling have different implications. *Correlation does not mean causality.* Does analytical maturity drive business performance, high performance lead to analytic maturity or might any correlation be spurious—an empirical regularity with no theoretical merit? To illustrate this point, consider the following hypothesis 'Dogs cause homelessness'. In the positivistic sciences, hypotheses are grounded within an existing body of theory and even then interpreting the resultant quantitative statistical analysis remains exactly that—matters of interpretation rather than 'fact'.

Whilst this may seem like academic nit-picking *par excellence*, if these analyses are indicative of analytical use of statistics advocated by Davenport and Harris, then this is indeed 'new' science. Putting aside for a moment the contentious issue of whether or not methods designed to achieve statistical closure within the regulated world of physical science are *suitable* for analysis of open, social systems such as those within which ERP system implementations take place, their application would at least appear to require attention to particular 'scientific' caveats. I see no reason to doubt Davenport and Harris's assertion that 'the overwhelming majority of organizations … have neither a finely honed analytic capability nor a detailed plan to develop one' (p. 107). This sounds to me like a market in need of 'forward-orientation'. Adopting the same predictive spirit that underpins this book, initial sales suggest that Tom Davenport and Jeanne Harris's book will become a contemporary management bestseller ranking alongside *The Goal* and *Competing Against Time*, for I do believe there is something in what they say about this yearning for 'facts'—or the 'will to truth' as Michel Foucault might have had it. At the very least, we should expect a paperback edition, which would hardly be out of place on the business shelf in the airport-departure lounge bookstore, aimed perhaps at those slightly jet-lagged, time-poor executives who are wondering why they've not yet been rewarded with first-class club lounge status.

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Making Globalization Work

Joseph E. Stiglitz

New York, USA Penguin Group, 2006, xxv + 358 pp., US$26.95, ISBN 978 0 713 9909 9 hbk

A lot has been written on globalization, some of the weaknesses of globalization and the possible remedies. But there are comparatively few scholars in the social sciences who have made major contributions in the field of globalization and played an important role in shaping discussions and decisions on the issues of globalization arising in their areas of expertise. Joseph Stiglitz is such a scholar. He served in the White House from 1993 to 1997 as a member and then chairman of the Council of Economic Advisers under President William Jefferson Clinton. After leaving the White House, Stiglitz worked at the World Bank from 1997 to 2000 as senior vice president and chief economist.

During his time in Washington, Stiglitz traveled the world and met many government leaders and officials, as he studied the successes and failures of globalization. Stiglitz is a Nobel Prize-winning economist who remained involved in the globalization debate after returning to academia by visiting dozens of developing countries, continuing his discussions with academics and businesspeople, with prime ministers, presidents and parliamentarians on every continent. It is obvious that his research, his time in the White House and at the World Bank, made him understand the problems of globalization. He became very concerned with the issue of poverty in the less developed countries because he had seen countries where poverty was increasing rather than decreasing.

Making Globalization Work is a sequel to Stiglitz's previous book, *Globalization and Its Discontents*. Yet, Stiglitz's new book provides no new or sophisticated message on the pitfalls or benefits of a poor country participating in the globalized world economy. It is, rather, an attempt to show how globalization can do a great deal to benefit both the developing and the developed countries of the world. In this informative endeavor, Stiglitz offers a sweeping overview of the field of globalization. According to the author, 'globalization is the field on which some of our major societal conflicts—including those over basic values—play out. Among the most important of those conflicts is that over the role of government and markets' (p. xiv). Although it covers much ground, it is neither conventional text nor technical treatise. Rather, *Making Globalization Work* emphasizes the connection between economic and cultural attitudes to indicate how much of it is in economic decision making, and in so doing, shows how politics has been used to shape the economic system as well as economics itself.

So what does Stiglitz do to merit publication of his book? This book consists of 10 chapters. In Chapter 1, the author indicates that there was a discussion of reform at both Mumbai and Davis meetings. 'Experts and policymakers now agree on the areas where change has to take place. This book is concerned with the hardest question of all: What changes, large and small, will enable globalization to live up to its promise, or at least work?' (p. 13). He also discusses the six areas, recognized by the international community, where progress has not been made. These areas include *the pervasiveness of poverty, the need for foreign assistance and debt relief, the aspiration to make trade fair, the limitations of liberalization, protecting the environment,* and *a flawed system of global governance.*

Stiglitz informs the reader in Chapter 2 that there are no magic solutions or simple prescriptions for development. It is a process that involves every aspect of

society, engaging the efforts of everyone such as markets, governments, NGOs, cooperatives, not-for-profit institutions. He recommends two things in order to help developing countries strengthen democratic governance. First, democracy should not be undermined since the continued success of the East Asian countries after democratization, and the success of India suggest that economic success is fully consistent with democracy. Second, the developed countries should do more to reduce opportunities for corruption by limiting bank secrecy, increasing transparency, and enforcing anti-bribery measures.

In Chapter 3, the author argues that trade liberalization will have to be managed in a way very different from that of the past because it can, when done fairly, when accompanied by the right measures and the right policies, help development. He also carefully reviews the history of trade agreements, and concludes that today's international trading regime is unfair to developing countries. Chapter 4 takes a more detailed look at the discussions of the intellectual property regime. He notes that Trade-Related Aspects of Intellectual Property Rights (TRIPs) reflected the triumph of corporate interests in the United States and Europe. In other words, American and EU corporate interests have attempted to use trade agreements to force developing countries to adopt intellectual property laws that are to their liking. This attitude made Stiglitz believe that the critics of TRIPs are right: 'Critics of the intellectual property regime are, by and large, not suggesting the abolition of intellectual property. They are simply saying that there is a need for a better balanced intellectual property regime' (p. 106). Therefore, in this chapter, he tries to explain what a balanced intellectual property regime might look like.

I agree with the point Joseph Stiglitz makes by questioning Western priorities regarding natural resources in Chapter 5. According to Stiglitz, the West is heavily dependent on natural resources and receives them from developing countries. However, their interests do not always coincide with the well-being of the developing countries. He also states that:

> the political forces in developing countries that lead to persistent corruption and entrenched elites using natural resource wealth to increase their own wealth will not go away simply through pointing out the consequences of their actions or their lack of moral underpinnings. They hear the lectures from the West, but they see Western oil companies sending monthly checks to bolster repressive regimes—in, for example Sudan and Chad—and Western governments providing the arms that maintain the repression (p. 151).

The author concludes this chapter by recommending seven measures. He thinks that developed countries can undertake actions to help resource-rich countries by ensuring transparency to discourage corruption, reducing arms sales, using a certification system, targeting financial assistance, setting norms, limiting environmental damage, and having an effective enforcement.

While Chapter 6 focuses on how developing countries provide enormous environmental services for the benefit of the entire world and are not getting compensated in return, Chapter 7 details a set of legal forms that would prevent multinational corporations from despoiling the environment of developing countries. Stiglitz proposes a set of reforms regarding debt burden in Chapter 7. He argues that developing countries should borrow less than they have in the past and, when they do borrow, they ought to be able to do so in ways that shift more of

the risk to developed countries. What really makes me recommend the book is Stiglitz's analysis of what causes debt crises, which is presented in Chapter 8. He uses Argentina's crisis to illustrate the cost of mismanaging debt and the need to reform the system. This reform also includes the UN, the IMF, and the World Bank. While Chapter 9 focuses on the instability of the global financial system and the need for a new global reserve system, Chapter 10 presents a detailed discussion of the key political issues such as unskilled workers, impact of globalization on inequality, democratic deficit in global economic institutions. The author concludes his book by recommending a new global social contract between developed and less developed countries.

The author's goals merit sympathy. This book presents the author's own views and recommendations by highlighting the benefits and problems of managing globalization. Its major contribution is the recommendation of specific policy actions for developing countries. This is an important issue. However, some of the recipes are well known, such as the need for a stronger IMF or UN or the World Bank, and the need for a new global reserve system but not much has been done in terms of implementing policies for development in the context of managing globalization. This book gives a first step in this direction—a major reason why this book is well worth reading. I would recommend it to academics and students interested in development, as well as policy makers in developed and developing countries.

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Innovation and Knowledge Management: The Cancer Information Service Research Consortium

J. David Johnson

Cheltenham, Edward Elgar, 2005, 279 pp., US$100, ISBN 1 84376 910 7 hbk

It is often said that 'things come in threes', and this book is an example of that old saw. The content of this book is about the interplay or interrelations between *three issues*, *viz.* knowledge management (KM), innovation and consortia or networks. The focus of the book is on a single organisation, the United States Cancer Information Service (CIS), conceived of as an organisation concerned with KM. The ultimate objective (or mission) of CIS is to disseminate up-to-date information about cancer. Given this objective, CIS is regarded as a 'KM organisation'. Given the emphasis on this single organisation the book can be regarded as a case study.

It is important to realise that the CIS is a government organisation: in fact, it is described as 'the voice of the National Cancer Institute' (p. 3), and it provides (at zero price to consumers) information about cancer, one of the major mechanisms being a toll-free telephone service. However CIS has other programmes, e.g. those that are concerned with reaching disadvantaged groups characterised by medical underservicing. In this context it is relevant to observe that there is a geographical or regional dimension to this organisation: central-office provision is not possible for all services. Thus, the organisation faces a problem similar to that of providing governmental services to geographically dispersed populations in any nation state:

some services (e.g. defence) should be provided by a central government, given the nature of those services, whereas other government services (police, street lighting, etc.) are appropriately provided by sub-national levels of government. This issue is described as 'the assignment problem' in the public finance literature in economics.

It was pointed out above that there are three *issues* being considered, but there is potential for confusion. This is because the book is also concerned with describing and analysing *three innovations*. First, there is *service* innovation (introducing new information services about cancer), second, *production* innovation (implementing various technologies relating to KM), and third, an *organisational* innovation (the creation of a consortium designed to conduct research related to KM services). This consortium is the Cancer Information Services Research Consortium (CISRC).

Another complicating factor relates to the first innovation category, *viz.* service innovation: there are actually *three projects* being evaluated. The first of these is the '5-a-day for Better Health' project. At the end of a telephone call to the CIS, irrespective of the reason that prompted the call (e.g. a worry about melanoma), the caller would receive information about the beneficial effects of fruit and vegetable consumption. This can be described as either a proactive service, or an opportunistic health intervention. The second innovation involved encouraging women (with low incomes and members of minority groups) to have regular mammograms. Although this might sound like a standard health promotion message, what was unique was that this was an outreach programme because the CIS *made a call* from its telephone service rather than responding to in-calls from members of the community. The third project was entitled 'Quit Today! Smoking Programme for African Americans'. There were two components to this service innovation. First, there was a multimedia (radio and television) advertising campaign (directed to adult African Americans) with a two-pronged message, *viz.* 'Stop smoking, and call the CIS Quit Line for help'. The second component involved comparing the efficacy of newly developed self-help smoking cessation materials tailored to African Americans and the standard (non-tailored) CIS smoking cessation materials.

The text is divided into seven chapters, the first being an introduction and summary. Chapter 2 argues that there are 'levels of innovation', more generally *different types* of innovation, and then proceeds to consider factors that will determine the success of an innovation. Chapter 3 presents a history of the CIS, with an emphasis on its formal structure. Chapter 4 describes the CISRC in some detail and the role of cooperation in knowledge generation and the implementation of innovations of knowledge delivery. Chapter 5 describes the array of informal communication channels used by the CISRC: it is this chapter that is concerned with innovations in production associated with informal communication channels, portrayed by network analysis. It is in Chapter 6 that the results of Johnson's four-year longitudinal study of the CISRC are presented. The final chapter, Chapter 7, gives an account of 'lessons learned'.

Johnson places some emphasis on the organisational innovation represented by the CISRC, defined as 'a consortium of cancer-control researchers and practitioners who formed a coalition to implement trials related to three major cancer control projects …' (pp. 8–9). It is pointed out that this organisational form (a research consortium of 'players' in the health sector) is but one of various (new) organisational relationships in both the private and public sectors, e.g. franchises, joint ventures, network organisations, social service joint programmes, strategic alliances, etc.

Having defined the CISRC as a 'consortium' doesn't convey a sense of what it does or its characteristics. An important dimension is that it consists of 19 Regional

Offices which cover (geographically) the entire nation. These Regional Offices have standard fee-for-service contracts with the CIS to provide services (with a common goal) for a specified time period. These offices retain their connections with their local sponsor or parent organisations (e.g. cancer councils or centres) while undertaking services for the CIS. Thus, although the provision of cancer information is publicly funded, no public production is undertaken: this is contracted out to the private sector, whether the firms be for-profit or not-for-profit.

According to Johnson the motivation for creating the CISRC was '… to develop the research potential of the CIS, foster collaboration among investigators and the CIS network, and move the service towards high-quality, peer-reviewed research' (p. 7). In other words, the CIS (and the NCI) wanted to transform the provision of simple 'health promotion' to joint production of 'health promotion' and 'cancer research'. In other words, the argument was not unlike those arguments that occur in universities that teaching and research involve complementarities: active researchers can enliven their lecturing responsibilities by illustrating to students the cutting edges of their disciplines.

What is the perspective of the author? The emphasis is clearly on organisational management: in fact *Innovation and Knowledge Management* … is part of a series entitled 'New Horizons in Management'. More specifically, Johnson's interest lies in undertaking 'network analysis', given his focus on communication: essentially 'network analysis' is a procedure for depicting linkage patterns between individuals. His empirical results are a world away from the work of economists working in the style, say, of Griliches[1] or Mansfield.[2]

Is there some striking omission in this work? It seems to me that there is an oversight, and it relates to the external environment of the public health sector in the United States. Since the late 1970s, the issue of 'governance' within the public sector has been a heated topic in economics[3] and public administration.[4] This governance issue is discussed under the rubric 'The New Public Management', which came to prominence in the United States with the Clinton–Gore 'Reinventing Government' programme of 1993, the slogan for which was 'Doing more with less'.[5] This background does not rate a mention. Clearly the external environment in which organisations operate is a relevant variable: networks extend beyond the interactions of the immediate actors in an organisation or a consortium.

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The Psychology of Coaching, Mentoring and Learning

Ho Law, Sara Ireland and Zulfi Hussain

Chichester, John Wiley & Sons, 2007, xi + 245 pp., UK£34.90, ISBN 9780470028445 hbk

This relatively small book has very big aspirations. It aims to 'reflect the latest thinking, research and development in coaching psychology with high-level theories, principles and practical applications'. It seeks to translate the 'fragmented concepts and hypes' that, in the authors' view, characterise the literature and practices in knowledge management and organisational learning, into 'a coherent body of actionable knowledge applicable to both individuals and organisations'. Actionable knowledge is defined, drawing upon Argyris,[1] as 'practical knowledge that is useful to practising coaches/coachees and mentors/mentees, and is at the same time grounded in well-researched, evidence-based framework'. It aims to have 'cross-cultural elements that make the theories universal and applicable across cultures' and demonstrate 'know-how and present exercises with step-by-step instructions as well as case studies'. Its intended audience includes: coaches, mentors and trainers who want to know more about the general theories and principles that underpin coaching, mentoring and training; psychologists who want to apply their experience to coaching, mentoring and training; senior executives and managers responsible for training budgets; to students of psychology considering a career in coaching; and a more general readership.

The authors are two Chartered Occupational Psychologists and a Business and Marketing Director, all of whom have substantial experience of coaching and mentoring programmes in the UK and internationally. They set out in the introductory chapter some of their underpinning principles and assumptions—that coaching, mentoring and learning are part of an integrative framework without a definite separation between them; that positive psychology and the psychology of learning provide a more useful theoretical base than therapeutic models of 'abnormal behaviour'; that e-coaching and e-mentoring are a significant part of the market; and that diversity and cross-cultural issues are of central importance.

The book is structured so that different chapters are aimed at different audiences. Chapter 3, Philosophy and Theories of Psychology Applicable to Coaching and Mentoring: Learning Processes/Theories, is aimed at coaches, managers and general readers who want to know more about the general theories that might be applicable to coaching. It is a relative tour de force of psychological theories of learning. It starts by briefly reviewing the epistemological tradition covering objectivism (reality is external and independent of the learner), pragmatism (reality is external and internal) and interpretism (reality is both external and internal and constructed by the learner through thinking). It then reviews the experimental tradition including the principle of association (learning is by direct association and prior knowledge has no effect on what we continue to learn), law of effect (the association of sensation and impulse to an action), classical conditioning theories (Pavlov's work on stimulus/response) and gestalt theory (knowledge requires the learner to actively impose organisation—the gestalt—on sensory data). It then moves on to more recent approaches in social learning theories, particularly locus of control theories—are the factors controlling the outcome internal, external or chance?—and ways of rewarding and reinforcing learning. It touches on goal-focused learning and some of the research into promoting self-efficacy in learning, for example, citing Albert Bandura's four ways:

- providing feedback on the learners' own capabilities;
- providing comparative information about the attainment of others;
- tell learners what others believe them capable of achieving; and
- learners judge their own ability to engage in the task at hand (p. 33).

It then reviews motivational theories—Maslow's hierarchy, Merton's self-fulfilling prophecies to account for under-achievement and Expectancy Valence Theory: that the rewards must satisfy an important need and the desire to have the need satisfied is strong enough to make the effort worthwhile. They point out that these theories of learning tend to be very individualistic and that there is interplay between individual learners and the environment in which they operate. The chapter then reviews learning theories and the authors develop Kolb's learning cycle into a learning wheel, reflecting that to move the wheel requires an upward transformation from concrete experience to the formation of new consciousness and a forward movement which requires a behavioural shift and external action.

Constructivist–development theories come next. They do not describe constructivist theories in any detail but concentrate on cognitive development theories and the work of Bruner on different forms of representation and Vygotsky on the 'zone of proximal development'—the gap between what is known and familiar and what it is possible to know. The authors themselves regard coaching and mentoring as forms of social collaboration, in which the coach or mentor provides the coachee or mentee with opportunities to bridge the 'zone of proximal development'. They then explore some of the theories of meaning-making and Ausbel's theories on how memories and meaning are stored and recovered, suggesting that Bartell's notion of schema or data structures enhances these ideas. The chapter ends with a section on the implications for coaching. They develop their 'complete dynamic coaching/mentoring/learning model' based on Kolb's learning cycle with the identification of meaning, past experience and new futures superimposed on it.

Chapter 6, Developing a Universal Framework for Diversity, Coaching and Mentoring, is a more general chapter aimed at all readers. The idea of a universal framework for diversity may at first appear problematic but the universal framework is a meta-model recognising that culture and context always have a role and significance in the success of coaching and mentoring. The model is an inverted triangle divided into four sections. Stage one is at the inverted apex. The four-stage process begins with a pre-requisite stage for diversity mentoring which relies on homogeneity between mentor and mentee, assimilation of personal experience and validation of the relationship. Stage 2 can involve movement into less homogeneous relationships and the consolidation of self in diverse, trust building relationships. Stage 3 is the exploration of new insights and assimilation of experience including the possibility that the mentee will move into a mentor role. Stage four is maturation of the project through using multiple mentors working in previously unknown zones. The chapter concludes with a long section based on Goleman's Emotional Competence Framework but developing its cultural competence into an 18-element dimension focusing on personal, social, cultural, and professional competence.

These two chapters are, in my opinion, the highlight of the book and, in line with best practice in the social sciences, I should set out my own theoretical roots and assumptions so you can make your own judgement on my views. I am a coach, although it is not the main focus of my business, and I am a coachee. My

chosen business is as a facilitator and I work with groups and teams to improve performance and bring about change. In my experience, many change programmes based on individual performance ignore the dynamics and power of groups to restrain and/or funnel the action of individuals. I have an academic background in psychology and also in knowledge management and business studies. My theoretical leanings are constructivist and towards discursive psychology, particularly the idea that persona and identity are fluid depending on context and environment.

As far as the chapter on the psychology of learning goes, it would make interesting reading for an established coach or mentor without a background in psychology and would assist their reflective practice and personal development. For example, the four steps of Bandura's model cited above could help add depth and richness to the feedback models in common usage in coaching. However, any such readers would need to bear in mind the implications of the authors' view that places mentoring and coaching within the frame of the psychology of learning. They therefore do not draw upon some of the wider psychological theories that would also be useful to coaches, such as discursive psychology and theories that individuals do not have one personality as previously believed but construct different personae in different contexts. A more in-depth exploration of constructivist theories might also help coaches and mentors understand how they and their clients create and can recreate their own reality.

The chapter on Developing a Universal Framework for Diversity is well researched and thought provoking. The authors draw on evidence from a wide range of theory and practice to support their four-stage meta-model and in particular the first pre-requisite stage in which there should be a homogeneous match between coach/mentor and coachee/mentee before moving to more heterogeneous relationships. The meta-model is clear. However, the later sections that seek to flesh out the development of cross-cultural emotional intelligence turn into a sort of multi-statement, self-assessment questionnaire focused on the individual and not the group or environment in which they interact.

The other parts of the book are less impressive. Chapter 2, entitled Coming of Age: Coaching, Mentoring and Positive Psychology, is a peculiar mix of factual information on the characteristics of the market in coaching, mentoring and training and information on the GROW model, one of the major models used by coaches, and on positive psychology which is then not included in the theoretical chapter. The authors do not cover Neuro-Linguistic Programming approaches, which are probably the other most common models in coaching, on the grounds that they are not based on evidence. Chapter 4 on definitions of coaching psychology, coaching, mentoring and learning is brief and to the point but rather strangely comes after the chapter on the psychological theories of learning. Chapter 5 on Becoming a Learning Organisation and Learning Community through Coaching and Mentoring is superficial if its aim is to create a coherent body of actionable knowledge. For example, it describes Nonaka and Takeuchi's[2] model of knowledge creation but seems unaware of the debate about whether this is an empirical or theoretical model, about the nature of tacit knowledge and whether it can be made explicit and transferred to other people, and of Cook and Brown's[3] work on the difference between individual and group knowledge and their belief that tacit and explicit knowledge are qualitatively different from each other. The chapter on Tools and Techniques covers a wide range of techniques, including a narrative approach developed by one of the authors yet the more theoretical chapters do not

mention research into stories and metaphors in both individual and organisational learning. In Chapter 8, the tools and techniques are developed into exercises and activities, often in the form of long lists of questions. Four case studies are described in Chapter 9: a programme in the health and social care sector, a transatlantic e-coaching pilot project, a community project using the narrative coaching technique, and the maintenance of a coaching programme through the development of a co-ordinator role. Chapter 10 advocates an evidence-based approach to coaching through well designed evaluation. The final chapter discusses some key points for the future, including emotional intelligence and cross-cultural competence, evidence based research and impact assessment, the development of supervision of coaches, training, coaching and mentoring standards, and ethics and the legal framework.

The fact that the book is aimed at very different audiences is problematic in terms of its structure and coherence. It is a book that an existing coach/mentor or manager in charge of coaching and mentoring may well want to dip in and out of. However, it is a book written from a single disciplinary stance—psychology—with a philosophical stance that coaching and mentoring are indivisible and focused on learning. In practice, people's expectations are often quite different. People and organisations purchase coaching to improve their performance and mentoring to support and sponsor the individual. Effective mentoring and coaching produces learning and insight for both parties. However, an effective coach in particular needs to understand different communication preferences, learning styles and motivational strategies and the organisational environment in which their client operates. As such, the book lives up to its aim to 'reflect the latest thinking, research and development in coaching psychology with high-level theories, principles and practical applications' but fails in terms of its wider aim to present 'a coherent body of actionable knowledge applicable to both individuals and organisations'.

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Control and Freedom: Power and Paranoia in the Age of Fiber Optics

Wendy Hui Kyong Chun

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Control and Freedom: Power and Paranoia in the Age of Fiber Optics by Wendy Hui Kyong Chun is a provocative examination of just how 'freedom' and 'control' came to architect the Web. The text has inter-disciplinary appeal and should be well received by critical geographers, cultural analysts and sociologists who study the emergence of technologies and their supposedly disruptive effects. The book sets out to historically uncover just how a technology that thrives on control was constructed and accepted as a medium of freedom. Her analysis takes the paradoxical conflation of freedom and control to account for how the Web was privatised when it became a public entity in the mid 1990s. In the text, Chun proposes that this unlikely juxtaposition between control and freedom is perpetuated by key myths which facilitated the mass adoption of the Internet as an egalitarian medium: that of user control and freedom to navigate in a virtually invisible manner. For Chun it was this representation of the Internet as cyberspace (as the freest of spaces), which accounted for its success. Her critical history of the Internet (as cyberspace) reveals just how the Internet became a theory and she builds on intelligent examinations of media references to support her key argument. For example, she focuses her attention on a special 1995 *Times* issue on cyberporn to illustrate how a general state of paranoia preceded the legislation of the Internet and later on she uses promotional messages designed to sell the Internet as a user controlled utopia. Her history and critique are informed by her readings of Gilles Deleuze and Michel Foucault; which account for, we could argue, the emphasis placed on the subjective experience and practice of race and sexuality that are central to the book. Chun appears to suggest that freedom of the kind that escapes the constraints to buy a product in a marketplace is facilitated by subjective experiences of race and sexuality. Her view is not a fatalistic one, as she suggests that despite the enclosure of the Internet, there is potential for democratic practices; however these are not dictated by the myths of ultimate freedom and empowerment used to 'sell' the Internet, but rather by the way in which the technology exposes one to others. Put differently by Chun, random encounters with others (and machines) are not under our full control and this may give access to experiences of freedom.

In Chapter 1 'Why Cyberspace', using detailed technical explanations of Internet architecture and code, Chun questions representations of the Internet as a utopian or dystopian place. She abandons the figure of the flânuer to consider how technology makes the user more visible than invisible, and borrows the term gawker, to argue that users are turned into spectacles. Instead of being anonymous and autonomous flânuers, the gawker is mesmerised by commodities and is him/her self objectified by somebody else's gaze. This is particularly so given that unbeknownst to the user his/her meanderings leave trails. On the other hand, Chun also sees the Internet as an accessory of more liberatory and democratic action, through its ability to help 'touch others'. She is not short to note, however, that this potential is constantly undermined by the paranoia that dictates the deployment of the Internet as a means of controlling.

The second chapter 'Screening Pornography' examines the great porn panic of 1994 and through this highlights the government's role in legislating Internet use. The explosion of cyberporn as well as its regulation paved the way for the articula-

tion of a marketplace. In this chapter the author suggests that it is Internet languages, such as hypertext markup language (HTML), hypertext transfer protocol (HTTP) and JavaScript that facilitate interactivity rather than user control. Here she furthers one of her key arguments, which is that the more liberal democratic uses of the Internet come about with risky and non-visible encounter between users.

Chapter 3, entitled 'Scenes of Empowerment', analyses the ways in which the Internet was packaged and sold as a commodity based on premises of racial and technological encounters. Using her evaluation of the MCI's 'Anthem' commercials, she uncovers representations of the Internet as a 'race free' medium. From that she develops an intriguing argument that presents such discourses not as egalitarian ones, but as a denial of the experience of race. Her analysis is not one that presents the Internet as do others, like Boyle and Rheingold, as a space that obliterates racial discrimination that may mar the offline world, but positions it as a radical repression of race itself. This she describes evocatively as a process through which one rids oneself of the 'body'; this is not a desire to get rid of discrimination, but the possibility that the body itself may bring about exclusion. Again, Chun interjects the case of pornography and describes how race itself emerges as a category of pornography and a commodity.

In the following chapter, 'Orienting the Future', the author develops her running argument which espouses control and freedom to questions of race by looking at the US and Japanese cyberpunk. What the cyberpunk creates for Chun is sheer exotism and eroticism of others and other spaces; this is done through the reduction of human experience into data. She finds in William Gibson's book *Neuromancer* and Mamoru Oshii's animation *Ghost in the Shell* how representations of cyberspace fuse the biological and technological and end up privileging sexual reproduction and evolution.

Previous chapters build up to the key chapter of the book 'Control and Freedom'. In this chapter her critique of political paranoia and how this is exercised through a narrow definition of freedom is more fully expanded on. The conjuncture of media representations, objectification of race and sexuality, hardware and software specifications discussed in earlier chapters are revisited to tease out opportunities for freedom. Her analysis of freedom based on Jean-Luc Nancy's formulation of freedom as something that cannot be controlled opens up opportunities for sharing and relations that may exceed attempts to control. Chun is referring here to a broader definition of freedom that escapes the constraints of freedom as given by and experienced in the market.

For those studious of power and freedom within social and political sciences who are keen to unpack and question how disruptive technologies may or may not reproduce certain structures of domination or facilitate experiences of freedom, the book makes an important contribution. The book is an important one inasmuch as it presents a competing critical history of possibility that enabled the Internet to be seen as a site of freedom, regardless of it being a technology of control. In essence she accounts for and questions the ways in which political paranoia weaves in a web of control through the Internet, put differently by Chun, 'a paranoia that stems from the attempt to solve political problems technologically'(p. vii). The work cleverly presents a paradoxical rewriting of the Internet from the lenses of control–freedom, which enables her to escape the constraints of the well worn empowered-controlled binary that seems to dominate much of the literature. To that effect, the book offers a provocative analysis that intelligently

covers the hardware, software and extramedial representation of the Internet, to provide a refreshing and richly contextualised account.

Unlike others, like Iain Boal and James Brook[1] or Kevin Robins,[2] who have written damning critiques of utopian constructions of the Web, Chun suggests that is the very myth of freedom which permeates such discourses that connects the Web to the real world and makes it a public space. Put differently, Chun sets out to see how constructions of cyberspace were materialised in the promotion of the Internet and the practices it engenders. Some aspects of Chun's work could remind the reader of Tim Jordan's *Cyberpower*,[3] inasmuch as both problematise easy classifications of the Internet as a source of ultimate freedom. Chun evaluates this freedom as a marketing gimmick to package Internet technologies as prosaic providers of ultimate freedom. That is freedom to move and shop around. This very distinct notion of freedom which makes it possible to facilitate the development of a market economy is what is used discursively to not only typify the technology but to colonise it. Similarly, Jordan sees freedom as a discursive ploy advanced by digital libertarianism, which in essays by Barbrook and Cameron[4] and Millarch[5] is described as a Californian ideology enthused by libertarian and free market economy principles. However, Chun, like Barbrook and Cameron and Millarch, is very critical of a type of freedom that responds to market dictums. This makes the Internet vulnerable to the artifices of control. It follows then, that unlike the assumption that the online world is autonomous from the real world and its architecture immune to any type of control, businesses providing the software and network through which end-users engage with Internet content provide a necessary middle-layer through which control can be exerted. For example, Internet Service Providers (ISPs) can be asked to block certain types of materials from being accessed and formats can be watermarked in order to restrict their usage. With Chun, the reader savours the advent of a freedom to navigate and exercise freedom of choice as one that dissipates the more 'open' nature of the Internet as a public space. In that respect, Chun's Internet is somewhat distant from the early 1990s cyberlibertarian and utopian construction of the Internet as a 'free space' and joins more critical and situated analysis of its emergence and functioning. While the Californian ideologues, enthused by their libertarian and free market economy principles in particular, heralded the Internet as a source of a more egalitarian distribution of power, Chun situates that as rhetoric to sell against another type of freedom.

Another noteworthy contribution the book provides in terms of our understanding of Internet environments and the social practices that take place there is Chun's call not to overlook the hardware and software applications that make up the Internet. Generally, discussions of this nature are non-existent in reading social life in cyberspace, and it is her detailed examination of protocols and her scrutiny of those technical nuisances that provide the most revealing glimpses of how control is manifested but also subverted. Chun suggests that unlike populist constructions of the Internet as a user control medium, the user is unable to control the paths followed by the data emitted by their actions. That is, users will never really control the conversations that take place within machines which makes networking possible in the first instance. For Chun, Internet users are more adequately described as gawkers; they are not free to roam around as the anonymous flânuer, but instead are made spectacle themselves and are observed by others.

For the more informed reader, Chun's work will be illuminating and challenging; for those who are not familiar with Deleuze and Foucault, the text may seem

too difficult to follow. This is because Chun only dedicates a few paragraphs to explaining 'control' and control societies based on her readings of Deleuze and why and how the Internet may be an exemplar or not of that kind of technology. Her discussion of freedom for instance is much better articulated. For those not familiar with Foucault's own trajectory to understanding power and resistance from a disciplinary model to his later ethical period, some of what is mentioned by the author too, may be difficult to understand. She writes of biopower, without expanding or explaining the concept. While the author does provide lengthy and comprehensible annotations on just how sexuality is linked to power, the jump made to experiences of race is more difficult to follow. Considering that it is in race and sexuality that Chun suggests experiences of freedom lie, it is a shame that such explanations were obscured by a separation of experiences of 'freedom' cited in the text (Chapters 3 and 5) and their subsequent analysis at the end of the monograph. The book should nevertheless add positively to a more critical and contextualised understanding of social life on the Internet.

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Science and Technology Policy for Development: Dialogues at the Interface

Louk Box and Rutger Engelhard (Eds)

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Interest in the connection between science and technology (S&T) and development is not new. Industrialized countries made the link between S&T and economic growth a long time ago, prompting them to foster innovation—and consequently productivity growth and market share expansion—through research. And, for years, industrialized countries have allocated large budgets to the stimulation of industrial progress in the developing world. *Science and Technology Policy for Development* looks at the evolving nature of S&T policies, and how the lessons learned could be applied to supporting the development process. It is based on inputs from various experts in science and technology policy for development, presented at a workshop, entitled 'Providing Demand', held in Leiden in 2004.

From the outset, *Science and Technology Policy for Development* identifies a key disconnect between the donor and the receiver, which is particularly evident when money flows from developed to developing countries. In many receiving countries, researchers and policy-makers rarely understand the benefits of technological renewal, the need to capture indigenous knowledge or to re-engineer existing institutions to supply skills and knowledge to the productive sectors. In the book's first essay, *Knowledge Dependence and its Discontents: The Demand for Policy Research in Africa in the Era of Globalization*, Osita Ogbu calls for more S&T policy research in the developing world to validate the positive role of S&T in the development process.

However, contributors throughout the book illustrate that simply calling for investments in R&D and hoping that everything else will take care of itself presents us with another challenge. For nearly two centuries, scholars have cautioned against assuming that S&T leads directly to economic growth. Gibbons *et al.*[1] have characterized the traditional model—where scientists determine the agenda for scientific research—as the *Mode 1* 'linear model'. It represents a 'siloed' vision of science, where academic research is highly specialized and focused and is validated through the publication of articles in peer-reviewed journals. Such 'science push' research is isolated from the context in which its outputs might be used to address practical problems. That is to say, scientists are separate from those who might exploit the economic benefits that could be derived from scientific progress.

Academic institutions across the world subscribe to this process, yet it is arguably more prominent in economically advanced countries—i.e. those that have already mastered the more basic stages of economic development. Several chapters in this book show that development aid—earmarked for R&D—has traditionally been tied to the linear model, without questioning the model's validity. Although several efforts have been made to build technical capacity in the developing world, these efforts are founded on the *Mode 1* approach, leading to academic advancement, but without considering the complexities of economic growth.

A good example of problems arising from the uncritical use of a 'science-push' approach is evident in Léa Velho's contribution, where she investigates the scientific cooperation programs supported by Sweden's International Development Agency (SIDA) in Nicaragua for the past 20 years. The program was geared towards generating problem-oriented research capacities by providing opportunities for faculty members of Nicaraguan universities to pursue postgraduate degrees at Swedish universities. But analysis of the program indicated that the dynamics of knowledge production were not enhanced. Instead, researchers were trained to produce academic output, as opposed to addressing the needs of communities that might benefit from research activities. Although this program was intended to be demand-led, it inevitably created research capacity through *Mode 1*, which Velho rightly argues, does not lead to economic growth in developing countries. She attributes this approach to the standard interpretation that donor countries typically have of capacity building—i.e. an approach heavily influenced by the *Mode 1* paradigm, which is also easier to implement, monitor, and evaluate. Yet, ease-of-implementation could be seen as a necessary but not sufficient condition for success. Indeed, it could be argued that *Mode 1* approaches are not even particularly effective in the West. Granted, they generate state-of-the art research, but this clearly does not stimulate as much innovation and economic growth as Western governments have come to expect, given the significant investments made in research—hence the growing preoccupation of policy-makers in

OECD countries with the issues of private sector innovation and research commercialization.

Mindful of the limitations of *Mode 1* models noted above, Gibbons *et al.* proposed a second model of knowledge production. Accordingly, *Mode 2* knowledge-production generates transdisciplinary knowledge by bringing together various skills, experiences and knowledge sites to solve particular problems. In the chapter on South Africa, Johann Mouton describes how the country's university-based NGOs confronted apartheid's fragmented research agenda by directing foreign development agencies' funding towards research to serve the poor. When the African National Congress came to power, it aligned itself with the NGOs and attempted to formally reshape funding schemes, but ended up channeling money through formal research institutions. Many of the demand-led research centers lost their overseas funding and institutional base. By what could be described as a disconnect between the NGO network and that of the policy-makers, a functioning *Mode 2* model reverted to the traditional *Mode 1* model of knowledge production, where research outputs lack the indispensable network for their uptake.

In the two examples above, it is evident that dialogue and communication are needed at several levels. First, it should be recognized that the *Mode 1* approach to scientific research in donor countries significantly influences the approach to knowledge production in recipient countries, even though they might need a transdisciplinary and collaborative approach to problem solving (*Mode 2*). Second, opportunities for dialogue among stakeholders must be nurtured to ensure agreement on the appropriate course of action. This is expressed eloquently in Wiebe Bijker's chapter on policy dialogue, where he states: 'thinking about research and science must go further than the illusion that a combination of methodology and laboratories will automatically produce new scientific knowledge' (p. 110). A minimum requirement should be dialogue between researchers, policy-makers and political actors, who must be convinced of the importance of S&T to their country's economic growth.

One such way in which dialogue can be enhanced is through informed policy-making. In studying the evolution of Singapore's dynamic innovation system, Sunil Mani notes that Singapore did not rely on bureaucrats to design its successful innovation policies, but rather on an 'epistemic community' that became integrated in the administration of S&T. This community 'takes the form of informal networks of professionals with recognized expertise and competence in a particular field, as well as an authoritative claim to policy-relevant knowledge about that field or issue' (p. 75). Mani distinguishes this community from bureaucratic bodies, which may be perceived as seeking to preserve their missions and budgets in their policy-making. However, this distinction is not so apparent in the chapter by Paul Dufour, in which he calls for more creative ways to integrate various sources of advice. Given the changing nature of decision-making—to a more social and public value function—Dufour argues that sound knowledge strategies, based on 'decision-making structures that are both independent of states, but also linked to some form of accountability'—such as the scientific assessment mechanism as undertaken by the US National Academies—are needed for the advancement of society (p. 233). By referring to the Inter-Academy Council (IAC), which draws upon the advisory expertise of the world's science academies, he accurately identifies the need and emerging commitment to global collaboration in science advisory capacity. In both chapters, what emerges is the essential role that scientific advisory bodies have in integrating S&T into the development process.

It is perhaps the extensive development experience, combined with informed and transparent policy-debates, encouraged by bodies like the IAC, which has led to an evolution in donor perspectives on building a knowledge network. In Theo Van de Sande's contribution, he recounts unsuccessful attempts by the Dutch government to implement *Mode 2* in various countries. What emerges is that a *Mode 2* approach is inherently flawed—not in theory, but in practice, because existing research capacity in the South resides in ivory towers and is not demand-led. A *Mode 2* strategy thus lacks any domestic absorber capacity. The Dutch conclude that efforts must be made to stimulate dialogue among the groups in need, local researchers, and the policy-making partners, especially when consensus does not exist among local communities. Only when all actors are part of one network, can useful knowledge production emerge. Without explicitly stating it, the author is in fact pushing towards an evolution of *Mode 2* into a *Mode 3* that others, including Louk Box (a co-editor of the volume) have also proposed.[2] This would differ from *Mode 2* in that its focal point would be centered on demand and all stakeholders would be regarded as being on the same level, thereby establishing an effective dialogue across the private sector, government partners, researchers and donors. Thus would involve capturing existing networks of indigenous knowledge and generating skilled, demand-led researchers through the reform of technical higher learning.[3] Only if a network includes progressive politicians, enlightened policy-officials, demand-led researchers, a dynamic private sector and lateral-thinking donors, can *Mode 3* produce genuinely demand-led knowledge production.

Throughout the book, various forms of knowledge networks are discussed: local (Singapore), regional (NEPAD), international (co-authorship) and public–private partnerships. And, while the authors provide an encouraging overview of the evolving approaches to S&T for development, one cannot help but review our own path to innovation in the industrialized West, and the way in which we measure our progress.

For example, the standard measure of research activity—in both industrialized and developing countries—is publication intensity and specialization. This is captured in Caroline Wagner's chapter, where she demonstrates that between 1990 and 2000, developing country scientists increased their co-authorship in internationally recognized peer-reviewed journals, paving the way to new multi-level strategies (p. 169). Velho also experienced this in Brazil, where considerable investments in the scientific system have been made since the 1960s. Nevertheless, despite Brazil's contribution to mainstream science, which jumped from 0.4% of world publications in 1986 to 1% in 1999, its competitive position has remained quite weak. For example in 2002, Brazil ranked only 73rd among 162 countries in terms of human development, illustrating that a strong scientific system does not lead automatically (or at least quickly) to economic and social development (p. 63).

The above example, and many others throughout the book, demonstrates that standard policies in the industrialized world are often mimicked in developing countries. Yet often times, these policies are not sufficiently validated to justify their application in budding innovation systems. For example, significant public investments in R&D are expected to generate wealth and ultimately to enhance a nation's living standards. But, despite the numerous algorithms for determining research expenditure, we do not have real indicators of research efficiency in the sense of measuring the extent of technological application to our daily lives. Therefore, in the case of Brazil and many other countries, which are encouraged by the Western

example to invest heavily in R&D for economic development, it is difficult to justify such expenditures, because an economic indicator to measure adequately the benefits of S&T on the economy does not yet exist.

That is why the individual contributions in this book are so insightful. Whereas each author explores a different facet of how S&T policies are linked to development, there is a common thread that looks beyond publication intensity and investments, and considers the importance of networks. These networks—which are embedded in Western practice—are difficult to quantify, and do not fit within a typical algorithm that could measure their impact on innovation. However, by their example, each author articulates the vital role that they play in completing the innovation system.

To conclude, this book highlights the importance of networks in the innovation system. By recounting lessons learned, and providing suggestions for improvement, the authors invite donor countries to re-visit their development aid programs; and developing countries to take a broader approach at building and maintaining their innovation systems.

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