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# **Innovation in creative industries: from the Quadruple-helix model to the Systems Theory**

**Abstract:** Knowledge and creativity have always played a key role in the economy. Since the 2000s, the relevance of the creative industries, a high growth sector, has been pointed out as long as its strong and positive effects on jobs and economic growth. In the current context of rapid globalization and technological development, the innovation system is getting even more complex because it implies a shift in research focus from the supply to the demand side environment (consumption-driven economy). The authors focus on theoretical approaches coming from management and media studies able to explain the current paradigm shift in innovation and knowledge production and use: the Triple Helix model (and its developments) and Systems Theory. As an interesting case study, the Creative Enterprise Australia (CEA) is analyzed according the theoretical approaches shown. The paper tries to shed new light on the evolving role of knowledge pointing out the overlapping relationships between all the actors involved and the interpenetration of systems, and the prominent appointment of the media as an interpretative framework of the convergence of the depicted theories.

**Keywords:** Quadruple helix model, Systems theory, technology transfer, creative industries.

## **1. Introduction**

Knowledge and creativity have always played a key role in the economy. It is generally recognized that developed countries are moving from economies based on tangible assets to ones based on commercialization of intellectual property and other intangible assets (research and development, computer software, design, brand, human capital, organisational systems, etc). In this process academic entrepreneurship represents a relevant asset for the economic development.

Entrepreneurship among academics is not a new phenomenon. Well known case studies, such as the development of Route 128, Silicon Valley (Saxenian, 1996) and Waterloo region (Colapinto, 2007; Bathelt and Hecht, 2008) showed that academic clusters play a key role in promoting and fostering innovation. Academic entrepreneurs act as boundaries spanning between science and business, thus facilitating cross-fertilization and alignment between the two communities.

As pointed out by Cunningham et al. (2003:10) the creative industries (including for instance advertising, design, film, music, television and radio, and performing arts) are a high growth sector, positively affecting jobs and economic growth. The innovation system is even more complex because it implies a shift in research focus from the supply to the demand side environment (consumption-driven economy). Indeed, in the knowledge economy the co-creation with consumers, who have become richer, demanding and better educated, is increasing

Creativity and innovation are overlapping concepts: indeed, creativity is about the origination of new ideas. The creation of ideas, images, symbols, design and cultural expression should be considered a

national asset in multiple ways. Creative industries produce a high degree of both expressive and functional value (The Work Foundation, 2007) and they are a risky sector due to the characteristics of the experience goods produced. The Work Foundation's report (2007) identifies eight drivers of the creative industries: demand; greater diversity; a level playing field; education and skills; networks; public sector; Intellectual Property; and building greater business capacity. Some of these can be influenced by government, some by industry. As a result the interactions between different players, such as industry, university and government, are key areas and the classical Triple Helix model can be applied.

In the advanced economies, such as the United Kingdom and the United States of America, the pattern of investment has changed; and investments in intangible assets (from human resources and capabilities, to organisational competencies and relational capital) now equal or surpass investments in physical assets (machines and buildings). Moreover, creative, entrepreneurial individuals are becoming increasingly important resources for companies.

The paper focuses on different theoretical approach coming from management and media studies able to explain the current paradigm shift in innovation and knowledge production and use. In section 2 the theoretical approaches are introduced and discussed. As an interesting case study, the Creative Enterprise Australia (CEA) is analyzed at the light of the theoretical approaches shown. Section 4 concludes. The paper sheds new light on the evolving role of knowledge pointing out the overlapping relationships between all the actors involved and the interpenetration of systems.

## **2. Theoretical framework**

Economic growth does not rely anymore only on the traditional production's factors (land, labour and capital). Lucas (1988) showed that the production of human capital is an economic activity being relatively intensive in human capital as an input. Other economists highlight the weight of technological progress, in particular the literature stream, led mainly by Romer (1986, 1990), considers ideas as the relevant engine of growth. In the last decade a paradigm shift has occurred introducing new ways of collaboration between different actors and the integration of commercialization, empirical knowledge and the public good in order to sustain economic growth at national level.

Traditionally, innovation was conceived in linear terms, that is the elite science universities or the laboratories in the large corporations would generate a flow of inventions that in turn would be commercialised. Nowadays innovation and research benefits from evolving and overlapping relationships between academia, government and industry: innovation is a more systemic process, with an accent on effective coordination of a system in which high skills are widely diffused in different areas.

In the context of creative economy the innovation systems is characterized by cross-sectoral linkages and inter-dependencies, between creative industries, cultural institution, content and applications production, Government and other industries, as well. The lack of risk and working capital within the industry has been widely reported; as a result governments need to continue to look to seed fund new

capabilities and to provide incentive for sector growth in order to attract investor attention (another relevant helix of the innovation system).

## **2.1 The Helix approach**

In the last decades, in several countries the rigid division of labor between Universities and business started to fade away, moving from the ivory tower model to the Triple-Helix model (THM). This second academic revolution, integrating a mission for economic and social development is transforming the traditional Teaching and Research University into an Entrepreneurial University. A theory explaining this new setting is the Triple Helix model (Etzkowitz and Leydesdorff, 2000; Etzkowitz and Zhou, 2007), which is a development strategy based on collaborations among university, industry and government, where the university has the leading role in innovation. This model, which implies instability, better explains the relations in the non-linear innovation process, since we can state that in the knowledge-based society innovation is characterized by an iteration model well-integrated in the ecosystem.

We can identify two main guidelines for the transformation of academic institutions: capitalization which means that knowledge is created and transmitted for use as well for disciplinary advance; and interdependence that is the entrepreneurial university interacts closely with industry and government and it is not anymore an ivory tower isolated from society.

The trilateral interactions described by the THM are taking their role in the technological universities since 1950s, but nowadays the change is relevant in every field. Moving away from the isolation, universities have created technology transfer/licensing offices and press offices/media centres in order to establish a point of contact, to enhance the reputation and visibility of the University. The mere possession of potentially valuable knowledge assets within an organization is not enough; a transfer of knowledge is more and more necessary in the new competitive scenario.

More recently developments and extensions of the THM have been presented to better or further depict the innovation and economic growth patterns. Considering financing one of the main drivers of the innovation process, we think that a relevant role is played by financing organizations (see Carayannis & Campbell, 2006), besides the actors of the Triple-Helix model. Some clusters (e.g. Silicon Valley, Route 128 and Waterloo Region) have shown the importance and the role of VC companies (Colapinto, forthcoming). Moving forward from the triple-helix model, a “Quadruple Helix” model involves financing organizations which are needed to foster revenue growth and commercialization: this helix

could be considered the fourth partner in a revised model for explaining the knowledge-based economy. Innovation is sustained by free interaction of information, human resources, financial capital and institutions.

Another extension, development of the model, the Quadruple Helix Innovation Theory, includes as a “fourth helix” the “media-based and culture-based public” or civil society (Carayannis & Campbell, 2009; Khan & Al-Ansari, 2005; Alfonso et al., 2010). Arguing that the triple helix model is not a sufficient condition for long term growth, this fourth helix associates knowledge production and knowledge use with media, public discourses, creative industries, culture, values, life styles and art. In other words, creative industries, arts and art universities represent crucial assets for the evolution and advancement of knowledge economies.

To sum up, all the versions highlight the interplay between different players as the engine of creativity and innovation. This analytical model enables to specify relevant categories for observation in terms of expectations and to depict the co-evolution process which leads to innovation.

## **2.2 Systems theory: an alternative perspective on knowledge creation**

An alternative but similar approach to the Helix-model is offered by Niklas Luhmann's assumptions based on the theory of social systems. Whereas the helix model is a strategy of development based on the collaboration among different institutions such as universities, firms and financial actors and governments, systems theory raises questions about how society is organized on a macro-level in different functional systems such as politics, economy, media or science and which relationships are upheld between them: “Society can be seen as functionally differentiated, when it constitutes functional systems in order to solve specific problems” (Luhmann, 1988).

As Willke (1996) is arguing, the modern systems theory has become one of the main paradigms within social sciences because the highly organized society can only be analysed through theories with a sufficient self-complexity. One of the major advantages of a system theoretical approach is, that it sensitizes the scientific observer to be careful with normative prescriptions or determinism. Thus, it can be said that Luhmann's approach is suitable for sharpening and clarifying both theoretical concepts and empirical observations (Görke & Scholl, 2006). Within the social sciences systems theory has for instance been used for the analysis of ecological problems (Palmer, 1993), risk communication (cfr. Kohring & Görke, 2000) and generally within communication sciences and media studies (for an overview see Scholl & Weischenberg, 1998).

However, systems theory can also be applied to the relationship between science and society. Central to this analysis is the function of science journalism within society, particularly the ambitious effort to theorize it within the framework of systems theory provided by Matthias Kohring (1997). Previous studies focused on a rather descriptive level on science journalism, without taking into account that it should not be isolated from a general theory of journalism. That is, a specific theory of science

journalism should be deduced from journalism theory. In Kohring's notion, the function of science journalism is to observe the entire society – and not only the scientific system – for events, which establish environmental expectancies particularly in the environment of the scientific system. In other words, science journalism covers events, that can be of particular interest for the environment of the scientific system in order to develop expectancies, or events in other systems, which can be adapted to the scientific system. Thus, one can say that the scientific system delegated the communication of scientific findings to the broad society to science journalism in particular (Kohring 2005). However, “science journalism is conceptualized as an observation of science according to rules that are different from those of the system being observed” (Peters et al 2008). Following this argumentation, scientific journalism observes and describes autonomously the interdependencies between science and society. Kohring argues that the main selection criteria for science journalistic coverage are multi-systems-relevance. That is, scientific events chosen for news coverage are such events that are of great interest in the social context of science, i.e. in other social systems, such as those news events considered to have medical, political, legal, economic or moral implications.

As Peters et al. (2008) argue, this systemic notion of science journalism has particular implications for the knowledge production within society:

“One of the consequences of this conceptualization of journalism is that journalism is seen not as a transmitter of knowledge but as a producer of knowledge. Observation of society results in media constructs, which represent a specific type of knowledge about the world that is influenced by the media logic.”

These conclusions show that science journalism as part of the media system is of fundamental importance not only in divulging scientific findings within society, that is its function within society, but also for the production of knowledge itself. It seems therefore that the above mentioned Quadruple helix, which associates knowledge production and knowledge use with media, is of particular importance in order to understand knowledge production in modern societies. Moreover, systems theory allows to understand knowledge production not only from a perspective of different institutions such as universities or governments, but how it is been produced within society, spread through journalism and swayed by media logic.

### **2.3 Convergence between different disciplines**

Although starting from different disciplines (management and social sciences) and diverse perspectives, the two theories discussed beforehand get to similar conclusions. Even though the two interpretative frameworks diverge in their heuristic approach, similarities are obvious. The helix-model stands for the collaboration between industry, universities, government (and media), in order to provide suited infrastructures necessary for innovations and economic development. Systems theory on the other hand facilitates the illustration of complex and complicated relations between different elements. Thus, it enables, as Hofer (2006) states, specific views, suited for the respective purpose of the system. These

two rather cryptic descriptions of similar approaches can be explained as follows: First of all, the Helix-Model is based on differentiation – a core aspect also in systems theory as Görke and Scholl (2006) point out:

“Social systems are by no means given objects, but constitute their identity by drawing a distinction between the system and its environment and by setting boundaries against their environment. The system is the difference between the system and its environment. [...] As systems constitute themselves through differentiation from their environment, (social) systems can be characterized and observed as self-referential, self-organizational, autonomous, autopoietic (= self-(re-)productive), dynamic and plastic forms of specific meanings.”

This argumentation has consequences for the function of a single system: the boundaries established through differentiation define its meaning and thus its function. This ascription is comparable to the one occurring with the different helices. From a systemic perspective, the different helices are indeed autonomous systems. In other words: industry corresponds to the economic system, government corresponds to the political system, universities to the scientific system and media to the media (or public) system. Leydesdorff (2006) himself argued, that

“an accordingly complex systems theoretical arrangement should combine the perspective of non-linear dynamics with the study of systems which process meaning in addition to and in interaction with [...] information exchange.”

Although the similarities between the core assumptions of the two theoretical approaches are recognized by several authors (cfr. Kim 2003; von Wissel 2007) – for instance the differentiation process leading to the constitution of systems in order to solve particular social and societal problems – a further common development of the two approaches has never occurred. That is surprising, mainly because systems theory embodies some remarkable potential to relate the process of knowledge production and transfer, and thus analyze the interdependencies between different systems, on a larger, social scale. This becomes clear by taking into account that the functional differentiation of modern society increases the interdependencies between the various systems as each system is highly specialized. The main problem is illustrated by Görke and Scholl (2006): “What happens if separate function systems, despite their mutual dependency, cannot take each other into consideration sufficiently because their instruments to observe the environment are not complex enough?” The same aspect occurs within the Helix-Model: how can the interactions between different helices assure knowledge or creativity growth if every helix has a different perspective on why information is regarded as relevant? In particular, we consider the version of the model introduced by Etzkowitz and Leydesdorff (2000) with hybrid organizations, where interaction and cooperation between the different helices fosters co-evolution of the actors. Such a (knowledge-based) society needs a specific system to integrate or at least synchronize observations of other systems.

A possible solution – and in our point of view one of the most relevant domain to push forward theoretical development concerning the convergence between the Helix-Model and systems theory – is a more prominent appointment of the media, i.e. of the “public”<sup>1</sup> system. The public system therefore acts as a primary observer within society and integrates information and knowledge throughout the existing systems. As the dominant subsystem of the public, the function of journalism is to observe, construct and reduce complexity with the help of its own rules by selecting and framing events (cfr. Kohring & Matthes, 2002). By doing so, journalism creates its own reality and conveys information not in a passive way, but produces an actively modelled orientation for society. The so called Quadruple Helix Innovation Theory is a first step into this direction, by associating knowledge production and knowledge use in particular with the media as crucial assets for the evolution and advancement of knowledge economies. Journalism<sup>2</sup> becomes a crucial player in today’s knowledge societies, though.

To sum up, we think that both the Helix-Model as well as systems theory can be fruitfully combined in order to mash up institutional and macro-level social theories when considering topics such as knowledge production or creativity and innovation. However, it seems that the role of media and journalism throughout the process of innovation and creativity is underrated and should be more thoroughly unpacked in terms of its (social) implications. Bockelmann (2011) makes a case when talking about science (reporting) in the media:

“If the media influence public opinion, increasingly report on science and at the same time are not acting as mere information providers for scientists but offer alternatively new evaluation standards in research, it is important from a scientific perspective to systematically investigate more in detail the relationship between science and the public, the role of the media in this relation and thus potential repercussions on the scientific system.”

However, we are certain that bringing together the two threads above and drawing on their strengths can help us taking the academic debate another step forward.

### **3. Creative industries in Australia: the case of QUT incubator**

Given the new mode of knowledge production, case studies can be enriched by raising the relevance of the dimensions involved. Our case study will be seen at the light of the different approaches presented.

The role and importance of creative economy in Australia is expressed by the only dedicated creative industries 'incubator' (QUT Creative Enterprise Australia, CEA), which assists emerging businesses, in the areas of film and television, music, design, and new media. It is the commercial arm of QUT's

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<sup>1</sup> The „public“ system is a concept mainly developed by Görke and Hug (1997), stating that the public provides a synchronization function by perceiving every other system from an external point of view, confronting them with the result of its perceptions. Journalism, as the dominant subsystem of the public, observes other systems such as the scientific system and provides to every other system “new, surprising, unexpected and often creative opportunities for follow-up communication within the system” (Görke & Scholl, 2006).

<sup>2</sup> Referring to the previous chapter, particularly science journalism and the journalistic construction or mediation of science becomes much more relevant in a society where knowledge and creativity play a central role.



Creative Industries Precinct, absolving the third mission of the university. The linkages with local communities, industry and civil society are reflected in the choice of being a co-op university, which represents another way of blending academics with industry.

The starting moment was the establishment of the first Australian Creative industries Faculty which has proved to be a catalyst for other changes and innovation across QUT, such as the ARC Centre of Excellence for Creative Industries and Innovation, the Institute for Creative Industries and Innovation (iCi, a multi-faculty research institute) and CEA, the business development agency.

The experiment is backed by the local government, which sustained the Kelvin Grove Urban Village, a master-planned community which brings together residential, educational, retail, health, recreational and business opportunities into a precinct. The so-called civil society is involved in the innovation process.

The incubator has a strong track record in supporting the growth of creative businesses: looking at the data, it has supported the establishment of more than 25 new start-ups, raised over \$8m investment and 140 creative industries businesses in its capacity as a national creative business development agency (CEA website). The mission is to provide creative business support services to build sustainable creative industries while at the same time, to profile the sector's role and value in the wider economy. Indeed it accelerates the business competitiveness of incubated ventures and helps to develop new commercial opportunities through three different tools. Besides the traditional facilities - including leading technology, office space and facilities (Creative Workspaces) – the essence is the connecting role of the precinct.

Key skills for innovation are the participation, the experiment and the sharing of suggestions about how to improve the production process, and management: 'Creative Business Solutions' represents a powerful driver of learning by doing and incremental innovation, helping hosted ventures to gain the vital business skills, knowledge and experience to run and build their business.

As products and services have become more elaborate, so knowledge necessary to value creation has become more specialised and dispersed: the role of 'Creative Connections' is to help sharing knowledge and building networks. The Work Foundation report (2007) confirms that the network has become the new organisational paradigm due to the fading boundaries within and between organisations which enhance 'synergies' between organisation units.

As mentioned in the helix model, the financial aspect is a relevant element for the development of new businesses. As a result, CEA has launched a business loan fund to assist Queensland based creative businesses. This Creative Business Loan Fund is run as an additional feature of Creative launch Pad, the specialist mentoring program.

In the last decade QUT has been able to inform industry innovation and deliver positive social change through close links with industry, government, and the community: in this scenario, new media, social media and interactive technologies act as crucial tools of synchronization and orientation functions.

## **5. Discussion and conclusions**

Our intent is to stress on the role of media (the public) and science journalism in the innovation system in order to contribute to the theoretical discussion. As already said the more prominent appointment of

the media is to act as an interpretative framework of the convergence between the Helix-Model and Systems theory. In this debate, we should include the exploitation of new media as an engagement and connecting tool to spread innovation culture and knowledge: in the 21<sup>st</sup> century traditional media are not fully able to answer to the needs of the globalized economy. The success of creative clusters depends as much on the ‘soft infrastructure’ (networking, knowledge, human capital, etc.) as on the ‘hard’ one infrastructure’. Important additional features to this soft infrastructure are new forms of digital networking, advanced and innovative workspace design, and other kinds of digital connections, all built on face-to-face interactions of physical spaces.

The analysis of the Queensland model helps us to point out that the networked economy is the main force transforming a region. Universities emerge as a significant driving force in moving the high technology and digital frontier, a rich source of intellectual capital for potential new venture formation. A major part of university’s mission today is how to transfer knowledge into feasible technology and then technology into commercial reality. Going beyond the traditional case studies, we have analyzed QUT as an interesting “entrepreneurial university” characterized by numerous linkages and knowledge flows with local firms in the creative economy and by relationships with all the player of the QHIM. There are different modes of knowledge and technology transfer; such as:

- 1) publications, patents and deliverables from fundamental and applied research;
- 2) the strategic role in this context of the public (and in particular of science journalism) through its synchronization function, conveying information as an orientation for society;
- 3) development of skilled human resources in graduate training and co-operative programs;
- 4) government and industrial sponsored research;
- 5) collaboration or consulting and technology licensing, the incubator helps in connecting clients with networks and opportunities (Creative connections);
- 6) spin-off and incubated companies, sustained by financial assistance.

In our opinion these six elements on the one hand side summarize the case analysis, and on the other hand, they could underpin the ongoing debate and foster the continuous integration of different models able to depict knowledge production, use and diffusion in a complex and globalized information society.

## **6. References**

- Afonso, O., Monteiro, S. & Thompson, M. (2010). A Growth Model for the Quadruple Helix Innovation Theory. NIPE WP 12/ 2010. Resource document: [http://www3.eeg.uminho.pt/economia/nipe/docs/2010/NIPE\\_WP\\_12\\_2010.pdf](http://www3.eeg.uminho.pt/economia/nipe/docs/2010/NIPE_WP_12_2010.pdf).
- Bathelt, H. & Hecht, A. (2008). Key technology industries in the Waterloo Region: Canada's Technology Triangle (CTT). *Canadian Geographer*, 34(3), 225 – 234.
- Bockelmann, J. (2011). Wissenschaftsberichterstattung im Spiegel. Eine Inhaltsanalyse im Zeitverlauf. In G. Ruhrmann, J. Milde, A. F. Zillich (eds): *Molekulare Medizin und Medien*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- Carayannis, E.G. & Campbell, D.F (eds.) (2006). Knowledge creation, diffusion, and use in innovation networks and knowledge clusters. A comparative systems approach across the United States, Europe, and Asia. Westport, London: Praeger.
- Carayannis, E.G. & Campbell, D.F. (2009). Knowledge Creation, Diffusion, and Use in Innovation Networks and Knowledge Clusters. A Comparative Systems Approach Across the United States, Europe, and Asia. Praeger Publishers.
- Colapinto, C. (2007). Venture capital district: from Silicon Valley and Route 128 to Waterloo Region Technology. *International Review of Economics*, 54(3), 319-343.
- Colapinto, C. (forthcoming February 2011). Exploring academic entrepreneurship in the Milan area. *Industry & Higher Education*.
- Creative Enterprise Australia, <http://www.creativeenterprise.com.au>
- Cunningham, S.D., Cutler, T.A., Ryan, M.D., Hearn, G. N. & Keane, M. A. (2003) Research and Innovation Systems in the Production of Digital Content and Applications. Content and Applications, Creative Industries Cluster Study Volume III. Commonwealth of Australia (DCITA) Canberra.
- Etzkowitz, H. & Leydesdorff, L. (2000). The dynamic of innovation: from National System and “Mode 2” to a Triple Helix of university-industry-government relations. *Research Policy*, 29, 109-123.
- Etzkowitz, H. & Zhou, C. (2007). The entrepreneurial University in Various Triple Helix Models. Singapore Triple Helix VI Conference Theme Paper.
- Görke, A. & Scholl, A. (2006). Niklas Luhmann's Theory of Social Systems and Journalism Research. *Journalism Studies*, 7(4), 644-655.
- Khan, M.R. & Al-Ansari, M. (2005). Sustainable Innovation as a Corporate Strategy. *Intellectual Assets Management*, Saudi Arabia. Resource document: <http://www.triz-journal.com/archives/2005/01/02.pdf>
- Kim, K.-W. (2003). Die Entwicklung der Wissenschaft in einem Schwellenland. Wiesbaden : Deutscher Universitätsverlag.
- Kohring, M. & Görke, A. (2000). Genetic Engineering in the International Media: an analysis of opinion-leading magazines. *New Genetics and Society*, 19(3), 347-365.

- Kohring, M. & Hug, D. M. (1997). Öffentlichkeit und Journalismus. Zur Notwendigkeit der Beobachtung gesellschaftlicher Interdependenz – Ein systemtheoretischer Entwurf. *Medien Journal* 1/1997, 15-33.
- Kohring, M. & Matthes, J. (2002). The Face of Biotech in the Nineties: how the German press framed modern biotechnology. *Public Understanding of Science* 11(2), 143-154,
- Kohring, M. (1997): Die Funktion des Wissenschaftsjournalismus. Ein systemtheoretischer Entwurf. Opladen: Westdeutscher Verlag.
- Kohring, M. (2005). Wissenschaftsjournalismus. In S. Weischenberg, H. J. Kleinsteuber, B. Pörksen (eds): *Handbuch Medien und Journalismus*. Konstanz: UVK, 485-488.
- Leydesdorff, L. (2006). The knowledge based economy. Upublish.com.
- Lucas, R. E. (1988). On the mechanics of economic development. *Journal of Monetary Economics*, 22(1):3–42.
- Luhmann, N. (1988). *Soziale Systeme. Grundriss einer allgemeinen Theorie*. Frankfurt a. M.: Suhrkamp.
- Palmer, A. W. (1993). News from the Rain Forest: Niklas Luhmann and the social integration of environmental communication. *Public Understanding of Science* 2(1), 157-187.
- Peters, H.P., Heinrichs, H., Jung, A., Kallfall, M., Petersen, I. (2008). Medialization of Science as a Prerequisite of Its Legitimization and Political Relevance. In D. Cheng et al. (eds): *Communicating Science in Social Contexts. New Models, New Practices*. Amsterdam: Springer.
- Romer, P.M. (1986). Increasing returns and long-run growth. *Journal of Political Economy* 94, 1002–1037.
- Romer, P.M. (1990). Endogenous technological change. *Journal of Political Economy* 98 (5), S71–S102.
- Saxenian, A. (1996). *Regional Advantage, culture and competition in Silicon Valley and Route 128*. Cambridge: Harvard University Press.
- Scholl, A. & Weischenberg, S. (1998). *Journalismus in der Gesellschaft*. Wiesbaden: VS Verlag für Sozialwissenschaften.
- The Work Foundation, NESTA (2007). *Staying ahead: the economic performance of the UK's creative industries*. Resource document: <http://workfoundation.net/research/publications/publicationdetail.aspx?oItemId=176>
- Van Wissel, C. (2007). *Hochschule als Organisationsproblem. Neue Modi universitärer Selbstbeschreibung in Deutschland*. Bielefeld: Transcript Verlag.
- Willke, H. (1996). *Systemtheorie II: Grundzüge einer Theorie der Intervention in komplexe Systeme*. Stuttgart: UTB.