

Governance of and by expectations

Kornelia Konrad (University of Twente)¹

Paper presented at the 2010 EASST Conference, Trento, Italy, September 2-4

Introduction

In recent years, various studies have examined how expectations create shared and contested socio-technical futures, coordinate innovation actors and contribute to shaping technologies and socio-technical systems. In particular, expectations have been shown to play a decisive role in transition processes, be it in the form of guiding visions as an essential part of transition management or more specific expectations at the level of niches and local projects (Geels & Raven 2006; Kemp & Loorbach 2006).

At the same time, expectations are themselves continuously coordinated and shaped in public discourses, in professional communities and in organizations. Furthermore, policy and corporate actors increasingly initiate dedicated forms of systematic envisioning and assessment, largely under headings such as roadmapping, foresight, technology assessment or future-oriented technology analysis, which do more than mapping out possible futures: they explicitly aim at coordinating actors and supporting priority setting and strategy building (Cagnin et al. 2008). In parallel, a professionalization and commercialization of expectation-building has taken place with experts and “promissory” organizations such as consultancies and other forecasting agencies playing a decisive role in organizing expectations in specific fields, and creating and serving a market for technological expectations by applying a rich ‘toolset’ of technologies of expectation-building (Bürger 2008; Pollock & Williams 2009; van Lente 1993). Hence, expectations play a decisive role in ‘governing’, that is, coordinating and shaping innovation and transition processes and they are themselves ‘governed’ in distinct ways.

In this paper, I propose the concept of governance of and by expectations, in order to capture a) the different modes of shaping and coordinating expectations, ranging from the seemingly ‘unbound’ expectations in societal discourses to expectations ‘tamed’ in dedicated foresight, visioning, forecasting and technology assessment processes (governance of expectations), and b) the different modes of how expectations coordinate and shape socio-technical developments (governance by expectations). This conceptualization is supposed to provide a comprehensive approach which sharpens our attention for different modes of producing and coordinating expectations, which at the same time is broad enough to capture, compare and relate these different modes. This analytical perspective opens up a number of important questions. What are the specific roles and effects of different modes of governing expectations in coordinating and shaping socio-technical developments and how are different governance modes related? For instance, what is the specific role of collective expectations and expectation

¹ Department of Science, Technology and Policy Studies (STePS),
k.e.konrad@utwente.nl

dynamics in public discourses compared to expectations shaped in systematic foresight, vision-building or TA processes and how do both 'governance modes' influence each other? That is, does it matter for the performative role of expectations how they are produced and coordinated? If it matters, how and why does the governance of and by expectations evolve and change over time – as a general trend and within specific societal settings as technology fields, societal spheres and organizations? And to what extent is it possible to modulate and shape these processes?

In the following, I will elaborate the concept of governance of and by expectations. Then I will investigate recent changes in the governance of and by expectations for two illustrative examples from stationary fuel cells and nanotechnology. I will show that changes were induced by the reflexive relations between expectations and the actors and institutional arrangements within an innovation field, when expectations which emerged within a given societal domain fed back on the structure that shaped them. I will conclude with an outlook on further needs for research and possible applications of the approach.

Governance of and by expectations

In general, the concept of governance draws attention to the different modes or institutional rules of coordination among individuals, organizations, societal subsystems and states, ranging from hierarchical steering to networks and market-like forms of coordination organized by both formal and informal rules (Benz et al. 2007: 14). In a similar way, the concept of governance of and by expectations raises the attention for different modes of how expectations contribute to the coordination of innovation processes (governance by expectations) and for the different modes how these expectations themselves are coordinated among individuals, organizations, communities and arenas (governance of expectations).

Expectations may be coordinated in a 'market-like' manner, for instance when various actors participating in a discourse voice expectations which others may accept, modify or contest. These 'markets' of expectations are based on certain generating structures and institutions, for instance the specific constellation of actors, communication platforms and rules of communication within specific discourse arenas as public discourse, techno-scientific discourse, or policy discourse. Furthermore, over the last decades very concrete expectation markets have emerged in the sense of expectations commercially produced and traded by consultancies and forecasting institutes. At the same time, expectations are negotiated among the participants of more or less closed networks and communities following more or less codified rules. These may be innovation networks and communities with limited numbers of more or less clearly defined participants. Furthermore, various forms of foresight are a particular type of this form of coordination; usually rather clearly delimited processes with regard to participating actors and duration over time following specified procedures. While a fully hierarchical 'prescription' of expectations seems to be a somewhat unlikely case, which might at best be observed in religious communities, some actors and organizations may hold a prominent or even dominant position in shaping

collective expectations (cf. Pollock & Williams 2009 for the role of the Gartner Group in the ICT world).

Coordination *by* expectations encompasses different modes and different forms of coordination as well. There is the comparatively 'soft' mode of coordination of actor strategies and actor constellations at times when expectations are rather fluid, when actors reciprocally position themselves by way of exchanging and mutually adapting expectations in discourse. Expectations become more binding, when certain expectations turn into institutionalized, collective expectations, which are part of a debated or taken-for-granted social repertoire, which constitutes a reference point for actors who feel a certain pressure to respond to them (Konrad 2006). In addition, expectations may become further institutionalized, if they are taken up as part of obligatory institutional arrangements, for instance when integrated as requirements and yardsticks into formal funding schemes or more informally as part of broadly accepted requirements (Moore's law) (van Lente et al. 1998).

It is important to recognize that there is de-facto as well as intentional governance, and that in practice these are entangled. De-facto governance refers to the patterns and structures of coordination that emerge largely non-intentionally from the interaction of many actors (Rip 2006a, b). Intentional governance can then be repositioned as the attempts of actors to influence the outcome of these processes. For expectations, both are visible. Social dynamics of expectations are the result of strategic 'discourse activities' of many actors (Konrad et al. 2009; Brown & Michael 2003; Geels & Smit 2000), yet the actual outcome can hardly be controlled by anyone. Moreover, increasingly attempts at creating more structured and formalized forms of expectation-building have emerged over the last decades, indicating that the more expectations are recognized as part of the de-facto governance structure, the more they are integrated into intentional governance. This tendency is most obvious in the vast array of foresight processes that has emerged in the last decades as a dedicated governance tool at various policy levels (Koschatzky 2005) and to some extent also in the corporate world (Cuhls et al. 2008). The kinds of societal expectations which will eventually emerge, become dominant or contested, depend on intentional strategies, formal processes and the non-intentional social dynamics of expectations.

Different ways how expectations coordinate and 'govern' innovation processes have been highlighted in a recent strand of research within science and technology studies, the sociology of expectations, which considers specifically the performative role of expectations in science, technology and innovation, that is, governance *by* expectations (Borup et al. 2006; Brown & Michael 2003; Brown et al. 2000; van Lente et al. 1998). Expectations motivate innovation actors to enter new fields, legitimate the allocation of resources, guide the interpretation of novel technologies, give definition to roles for various actors, and structure the societal debate on new technologies (Borup et al. 2006; Swanson & Ramiller 1997). As a result, expectations channel efforts into certain directions and contribute to the emergence and stabilization of socio-technical structures, institutional arrangements and paths – the actual directions taken may well deviate from early

expectations though, thus pointing to the importance of de-facto governance (Bender 2005; Geels & Raven 2006; van Merkerk & Robinson 2006). However, an explicit consideration of different governance modes *of* expectations and their specific role, such as competitive voicing of expectations or negotiation and adjustment within networks and communities, or more or less formalized forms of expectation-building has not been undertaken so far.

The intentional governance *of* expectations in the form of foresight, technology assessment or public engagement has been mainly addressed within an application-oriented literature focusing on setting up and conducting future-oriented technology analyses (Barré et al. 2008; Da Costa et al. 2008; Georghiou & Keenan 2006; Salo & Cuhls 2003). Little research has been done on the actual effects of these processes on policy-making and even less on corporate strategies or future-oriented technology analyses within firms (exceptions are Becker 2002; Cuhls et al. 2008; Müller 2008; Reger 2001). Hence, it is not clear to what extent de-facto governance overlaps with the intentions of these governance 'tools'. Studies investigating foresight impacts have focused on the impacts of single or a small set of exercises (Cagnin & Keenan 2008; Quist 2007; van der Meulen 1999; van der Meulen et al. 2003). Studies on the actual practices of foresight are the exception (Van 't Klooster & Van Asselt 2006). Studies of the impact of foresight at the level of an innovation field are rare, but have shown that the effects and appropriateness depend on the constellation of actors within a field (Brown et al. 2001).

Moreover, foresight processes and other dedicated expectation-building procedures should not be considered as more or less isolated processes having always clearly attributable effects on specific target groups, but be seen as local sites of processes of expectation-building within the broader societal discourses, or – put differently – as embedded in the larger “sea of expectations” (Borup & Konrad 2004; Truffer et al. 2008) with various interactions taking place between these different forms of expectation-building.

Finally, as we will show in the next section, there are reflexive relations between the expectations and the actors and institutional arrangements within an innovation field. Expectations contribute to coordinating actors, strategies and institutional arrangements, but their form and content depend also on these actors, strategies and institutional arrangements. In a dynamic perspective, this implies that the expectations which emerge within a given societal domain may feed back on the structure that shaped - and in a sense generated - them, and thus such structures may change affecting further processes of expectation-building and coordination. On a more general level, Hajer 1995) has described similar dynamics as institutionalization of discourses, that is, the translation of a discourse into institutional arrangements. In our terms this implies that governance by expectations feeds back on the governance of expectations. It is this issue which we will turn to in the following section.

Evolving modes of governance - the reflexive relationship between governance of and governance by expectations

From market to network coordination of expectations – evidence from stationary fuel cells

Fuel cells, which basically transform hydrogen or hydrogen-containing gases into electricity and heat, have been subject to recurrent ups and downs in collective expectations, so-called phases of hype and disappointment (Fenn 2006), with the most recent hype cycle culminating around the turn of the millennium. As shown by a recent study on expectation dynamics and fuel cell innovation in Germany, Switzerland and Austria, both rising and decreasing collective expectations played an essential role for the decisions of many innovation actors in industry, research, but also finance and policy, to enter or exit the field or modify their efforts (Konrad & Budde in preparation; Konrad et al. 2009). As a result, the actor constellation in the fuel cell innovation system changed - not only quantitatively by motivating or de-motivating significant numbers of actors, but also qualitatively, in the sense that specific types of actors were attracted more or less depending on the evolvement of the collective expectations. This affected the coordination of expectations and, ultimately, the expectation dynamics. In particular, changes in the expected time to market for fuel cell cars and stationary applications as microCHP created specific effects for different types of innovation actors. The (as we know by now) overly enthusiastic expectations in the late nineties and 2000, attracted actors from the financial world. This led to a coupling with the dynamics of financial markets and, thus, affected the governance of fuel cell expectations at the time, since it created a strong incentive for a number of stock-exchange listed firms to advertise fuel cell activities, which were neither before nor after the hype phase advertised in the same way. This is exemplified by a major fuel cell supplier firm.

Interviewer: We (recognized) that in 2000, 2001 the FC project occurred quite often in the press.

Respondent: That was the big media hype and the [supplier firm] is listed at the stock exchange and, thus, has to advertise itself. This played a role. [...] exactly, actively mentioned, plugged, and this has created a lot of positive resonance. [...] When after 3, 4 years no results could be shown, that is, not to the extent it was expected at the time, critical voices came up and rightly so. Since then we retreated from the public, settled comfortably within this [division] and there we are allowed to develop, so to say, unhurriedly ourselves and the market. [...] Sometimes we advertise our products in professional journals, but you will not see a press release by our company in the near term. (supplier firm A, sales and managing director fuel cells, 4/2008)

The following citation from a system manufacturer illustrates in more detail the specific interaction of technology firms and financial actors in contributing to hyping of expectations, the effects of which created repercussions for the firm.

...then there were a couple of [CEO] changes. And each time [the FC division] was on trial [...] This calmed down around 2001, with the threat of a hostile takeover [...] Then [the FC division] was taken to the surface; before it operated below the radar screen. In this way, the value of the firm was supposed to increase. [...] The strategy was successful. In cooperation with a bank, the strategy was developed how to communicate the FC story. Actually, it was only presented, how the [FC division] stood in comparison to others, certain technical features. But no conclusions were drawn; this was left to the financial analysts, to create a value for the [FC division] . And then the finance world presented values up to half a billion. And, of course, this was deployed [...] As a consequence, the [FC division] was on the radar screen of everybody, the finance world etc. And this had strong impacts. We had to present successes very fast to justify that in the long run, and this didn't fit with where we stood technically and how this could be taken to the market; there was a mismatch. (business manager, system manufacturer D, 6/2008)

This coupling with the financial dynamics amplified the hype dynamics, even though it did not initiate it. When disappointment with regard to time-to-market expectations became obvious, many financial actors retreated, while it was possible to enroll policy actors in the middle of the disappointment phase, largely due to the successful linking of fuel cell expectations with rising concerns over climate change. This resulted in a long-term support program, which arguably reduced to some extent the need for overly optimistic announcements.

In addition to effects resulting from changes in the actor constellation, we found strong indications that the modes of expectation coordination among major fuel cell actors were affected by institutional changes over the period investigated. Basically, this entails changes from a competitive, market-style mode, which was to some extent also driven by the dynamics of the financial markets just mentioned, to a more network-based mode of coordination, with new institutions as national and international associations, working groups and ultimately funding programmes emerging, where coordination of expectations took place, partly also based on the use of expectation-building 'tools' like roadmaps. Before and during the hype phase major actors voiced expectations 'individually' and a number of actors felt a strong pressure to come up with ever more optimistic or at least as optimistic expectations as their competitors. However, at the brink of the hype, when it became foreseeable that expectations were getting overly enthusiastic, a number of major fuel cell actors - system manufacturers and utilities - founded a new association and discourse activities, that is, public voicing of expectations, were increasingly coordinated among the growing number of members of this association. In the following years, further institutionalization in the form of working groups and ultimately a public support program took place. Related to this, expectations were increasingly coordinated in more formalized ways resulting ultimately in roadmaps and working programs (Strategierat Wasserstoff und Brennstoffzellen 2007), which served as a binding point of orientation for those intending to participate in the support program. These changes in modes of expectation coordination have arguably contributed to mitigation of hype just as the disappointment of specific expectations. Changes in the modes of expectation coordination as a reaction to expectation dynamics are made explicit in the following citation from a major manufacturer of microCHP fuel cell systems.

We [gas utilities and heating industry] have jointly recognized that we have somehow created a communication problem. Then the fuel cell initiative was founded. [...] The fuel cell initiative was strategically founded, in order to create a neutral communication platform and to get away from a person-driven company communication, as we had conducted before. Me personally, I have of course had a share in creating the hype, for the reasons explained before, because we had our plan and thought we would get it through. [...] But for mitigating the hype we gathered all at the roundtable and said, before our child that had fallen into the well drowns completely, how can we construct the ladder, which helps it to come out. And the ladder is the fuel cell initiative. And the communication of the fuel cell initiative has been moderate from the beginning. [...] This was a proactive approach to this problem [creation of hype] which we had created ourselves [...] Well, not alone, the others had joined in as well. We have then embedded the firm communication within the fuel cell initiative communication. Thus, it wasn't necessary anymore, that we ballyhoo in competition, each opposing the competitor, outbid each other with hype slogans; but we said, let us create this platform and become more moderate, in order to get it going according to a new timing, maybe in 2010. (former product manager, system manufacturer A, 6/2008)

In addition to the changes in the coordination of expectation voicing, the citation clearly shows the tension between intentional and de-facto governance of expectations and the reflexivity of the respective strategies. At first, discourse

activities of this system manufacturer aimed at intense communication of optimistic expectations (in line with the - at the time - optimistic expectations within the firm), in order to get installers and future customers interested. When confronted with the cumulative de-facto effect of the intentional attempts at governing collective expectations of this and other organizations, the strategy was revised, in order to mitigate the unintended effects.

In sum, collective expectations affected both the actor constellation and the institutional arrangements in the fuel cell innovation system. Since actors and institutions of the innovation system constitute part of the generating structures and institutions of collective fuel cell expectations², these changes affected the further processes of building and coordinating expectations and, ultimately, the social dynamics of expectations.³

Institutionalization of risk expectations – evidence from nanotechnology

A newly emerging field of science and technology that is overwhelmed with expectations, visions and – by now much more than fuel cells – also concerns is nanotechnology. Nanotechnology refers to a diverse set of research and technology fields rooted in different disciplines, which are addressing objects of manipulation at the nanometer scale. In recent years, risk concerns and fears have emerged beside the nanohype. Rip & Van Amerom (2010) describe in more detail how nano risk concerns turned from something which was put forward mainly by ‘outsiders’ as NGOs and reinsurance companies, but largely denied by many nanotechnologists, into a legitimate concern with a strong focus on health, environmental and safety issues, in particular related to nanoparticles. By now, they are part of the broadly accepted social repertoire of collective nano expectations - including both promises and concerns⁴ - within scientific, industry and policy arenas. More or less in parallel to the emergence of these legitimate concerns, other concerns as the possibility of a Grey Goo scenario and their protagonists, in particular the nanotechnology pioneer Eric Drexler, became excluded from mainstream nanotechnology and science (ibid.). Related to the emergence of health, environment and safety issues of nanoparticles as a legitimate concern, new actors joined the field and new institutions in the form of working groups and networks dedicated to risk issues were established (ibid.). In the meantime, institutionalization processes have continued with risk assessment studies becoming a required module of nanotechnology R&D programmes, the foundation of research centres, the uptake of measures aimed at contributing to responsible innovation in firms and, more specifically, the development of codes of conduct, and, finally, the setting-up of various forms of public engagement processes. Most important for our concern, these processes show that, in a similar vein as in the fuel cell case, the dynamics of social expectations and the emergence of certain collective expectations and agendas fed back on the actor constellations and institutional arrangements within the emerging field of

² In addition to the media system, financial world etc.

³ The changes affected innovation activities as well, but this is beyond the scope of this paper.

⁴ Rip and Van Amerom use the term de-facto agendas.

nanotechnology⁵ (governance by expectations). In so doing, the very foundations of expectation-building and coordination have been affected (governance of expectations). A detailed analysis, how exactly expectation-building and coordination have changed in this case, remains to be done; but given the observed changes, it seems likely that in parallel to the increase in technology assessment programmes and public engagement procedures, these dedicated and formalized modes of governance of expectations have gained in influence in the overall societal expectation-building. If this is the case, it may either reinforce (perhaps inflate) social dynamics of expectations and concerns due to the created attention, or mitigate them by introducing data-based checks. Furthermore, we may expect that the attempts to establish forms of responsible innovation have affected actual innovation processes. How and to what extent, needs further scrutiny.⁶

Outlook

In this paper I have proposed that it is necessary to consider the way how expectations are produced and coordinated in specific settings characterized by specific actor and institutional arrangements, in order to more thoroughly understand the way how expectations affect innovation and transition processes, and that we can usefully draw on general insights from governance studies for conceptualization. Furthermore, by drawing on two examples I have shown that the modes of governance of expectations within certain technology fields do change (reflexively) and that these changes matter for the performative role of expectations. We have observed changes in the 'generative structures' of the social dynamics of expectations (stationary fuel cells) and we have seen an increase in dedicated governance tools of expectations as TA in nanotechnology. In both cases these changes in the governance of expectations within a field have been related to shifts in the content of expectations.

While the immediate aim of this short paper has been to present the conceptual framework and illustrate its analytical usefulness and empirical value with two small cases, the conceptual perspective is supposed to open up a broader field of research. In terms of scholarly debate, the approach contributes to and integrates two so far largely unconnected literature strands. For the more analytically oriented sociology of expectations recently emerged within science and technology studies, it offers a comprehensive conceptual framework informed by general social science research. The practice-oriented approaches to expectation-building as future-oriented technology analyses are likely to benefit from a better understanding of impacts at the level of an innovation field and their relation to further anticipatory processes in society. While the presented findings are indicative of the usefulness of the proposed perspective, further research is necessary to understand the role of specific governance modes of expectations

⁵ It is debatable if we can adequately speak of a nanotechnology innovation system.

⁶ These issues will be taken up in an upcoming research program at the University of Twente.

for innovation processes and how different modes interact, in particular the dynamics of societal discourses and more formalized ways of expectation-building in foresight, visioning processes and technology assessment.

More specifically, the approach sheds new light on the issue of expectation dynamics, which has been a concern of scholarly debate and practitioners alike, by shifting the focus from coping strategies of individual actors and organizations to the modulating role of actor and institutional arrangements in a specific societal setting. The findings from stationary fuel cells call for further inquiry into modes of expectation coordination that may be more or less conducive to hyping and, in a second step, into ways of influencing them. The approach can also be applied for analyzing the specific governance and dynamics of expectations in different societal settings as science, policy, industry or finance or in differently structured technology fields. The observed changes in the governance of expectations in the two cases which both exhibit forms of increased institutionalization furthermore suggest that there may be typical sequences or patterns in how governance modes evolve in specific technology fields, potentially related to specific phases in innovation and transition processes.

References

- Bakker, S. & Engels, R. (2009). *Aggregating Expectations - Competing Trajectories of Electric and Hydrogen Vehicles*. Paper presented at the Workshop Expectation-building and Innovation Processes, September 17-18, 2009, Zurich.
- Bakker, S., Van Lente, H. & Meeus, M. (2008). *Arenas of Expectations for Hydrogen Technologies*: Innovation Studies, University of Utrecht.
- Barré, R., Keenan, M., Cagnin, C., Keenan, M., Johnston, R., Scapolo, F. & Barré, R. (2008). Revisiting Foresight Rationales: What Lessons from the Social Sciences and Humanities? *Future-Oriented Technology Analysis - Strategic Intelligence for an Innovative Economy* (pp. 41-52). Berlin: Springer.
- Becker, P. (2002). *Corporate Foresight in Europe: A first overview*. Brussels: European Commission Community Research.
- Bender, G. (2005). Technologieentwicklung als Institutionalisierungsprozess. *Zeitschrift für Soziologie*, 34(3).
- Benz, A., Lütz, S., Schimank, U. & Simonis, G. (Eds.). (2007). *Handbuch Governance: Theoretische Grundlagen und empirische Anwendungsfelder*: VS Verlag für Sozialwissenschaften.
- Borup, M., Brown, N., Konrad, K. & Van Lente, H. (2006). The Sociology of Expectations in Science and Technology. *Technology Analysis and Strategic Management*, 18, 285-298.
- Borup, M. & Konrad, K. (2004). Expectations in Nanotechnology and in Energy – Foresight in the Sea of Expectations. Background Paper - Research Workshop on Expectations in Science & Technology, April 29 – 30, 2004, Risø, Denmark.
- Brown, N. & Michael, M. (2003). A Sociology of Expectations: Retrospecting Prospects and Prospecting Retrospects. *Technology Analysis & Strategic Management*, 15(1), 4-18.
- Brown, N., Rappert, B. & Webster, A. (2000). *Contested Futures - a sociology of prospective techno-science*. Aldershot.
- Brown, N., Rappert, B., Webster, A., Cabello, C., Sanz-Menendez, L., Merckx, F. & van der Meulen, B. (2001). *Foresight as a Tool for the Management of*

- Knowledge Flows and Innovation (FORMAKIN)* (Report No. SATSU Working paper N21 2001). Brüssel: EU Kommission.
- Budde, B. & Konrad, K. (2009). *Interrelated visions and expectations on fuel cells as a source of dynamics for sustainable transition processes*. Paper presented at the 1st European Conference on Sustainability Transitions, June 4-6, 2009, Amsterdam.
- Bünger, M. (2008). Information and Imagination: How Lux Research Forecasts. In E. Fisher, C. Selin & J. Wetmore (Eds.), *The Yearbook of Nanotechnology in Society, Vol. 1: Presenting Futures*. Dordrecht: Springer.
- Cagnin, C. & Keenan, M. (2008). Positioning Future-Oriented Technology Analysis. In C. Cagnin, M. Keenan, C. Cagnin, M. Keenan, R. Johnston, F. Scapolo & R. Barré (Eds.), *Future-Oriented Technology Analysis - Strategic Intelligence for an Innovative Economy* (pp. 1-13). Berlin: Springer.
- Cagnin, C., Keenan, M., Johnston, R., Scapolo, F. & Barré, R. (Eds.). (2008). *Future-oriented Technology Analysis: Strategic Intelligence for an Innovative Economy*. Berlin: Springer.
- Cuhls, K., Johnston, R., Cagnin, C., Keenan, M., Johnston, R., Scapolo, F. & Barré, R. (2008). Corporate Foresight *Future-Oriented Technology Analysis. Strategic Intelligence for an Innovative Economy* (pp. 103-114). Heidelberg: Springer.
- Da Costa, O., Warnke, P., Cagnin, C. & Scapolo, F. (2008). The impact of foresight on policy-making: Insights from the FORLEARN mutual learning process. *Technology Analysis and Strategic Management*, 20(3), 369-387.
- Fenn, J. (2006). *Understanding Gartner's hype cycles* (Report). Stamford.
- Geels, F. & Smit, W. (2000). Lessons from Failed Technology Futures: Potholes in the Road to the Future. In N. Brown, B. Rappert & A. Webster (Eds.), *Contested Futures - A Sociology of Prospective Techno-Science*. Aldershot.
- Geels, F.W. & Raven, R. (2006). Non-linearity and expectations in niche-development trajectories: Ups and downs in Dutch biogas development (1973-2003). *Technology Analysis & Strategic Management*, 18(3/4).
- Georghiou, L. & Keenan, M. (2006). Evaluation of national foresight activities: Assessing rationale, process and impact. *Technological Forecasting and Social Change*, 73, 761-777.
- Hajer, M. (1995). *The Politics of Environmental Discourse*. Oxford: Oxford University Press.
- Kemp, R. & Loorbach, D. (2006). Transition management: a reflexive governance approach. In J.-P. Voß, D. Bauknecht & R. Kemp (Eds.), *Reflexive Governance for Sustainable Development* (pp. 103-130). Cheltenham: Edward Elgar.
- Konrad, K. (2006). The Social Dynamics of Expectations: the Interaction of Collective and Actor-Specific Expectations on Electronic Commerce and Interactive Television. *Technology Analysis & Strategic Management*, 18(3/4), 429-444.
- Konrad, K. & Budde, B. (in preparation). Varieties of Hypes & Disappointments: Fuel Cell Expectations in multiple discourse arenas.
- Konrad, K., Markard, J., Ruef, A. & Truffer, B. (2009). *Strategic Responses to Hype & Disappointment: the Case of Stationary Fuel Cells*. Paper presented at the Paper presented at the Workshop *Expectation-building and innovation processes*, September 17-18, 2009, Zurich.
- Koschatzky, K. (2005). Foresight as a Governance Concept at the Interface between Global Challenges and Regional Innovation Potentials. *European Planning Studies*, 13(4), 619-639.
- Müller, A. (2008). *Strategic Foresight - Prozesse strategischer Trend- und Zukunftsforschung in Unternehmen*: University of St. Gallen, PhD Thesis.
- Pollock, N. & Williams, R. (2009, September 17-18, 2009). *The Business of Expectations: How Promissory Organisations Shape Technology &*

- Innovation*. Paper presented at the Paper presented at the Workshop *Expectation-building and Innovation*, September 17-18, 2009, Zurich.
- Quist, J. (2007). *Backcasting for a sustainable future. The impact after 10 years*: TU Delft. PhD Thesis.
- Reger, G. (2001). Technology foresight in companies: From an indicator to a network and process perspective. *Technology Analysis & Strategic Management*, 13(4), 533-553.
- Rip, A. (2006a). A co-evolutionary approach to reflexive governance - and its ironies. In J.-P. Voß, D. Bauknecht & R. Kemp (Eds.), *Reflexive Governance for Sustainable Development* (pp. 82-100). Cheltenham: Edward Elgar.
- Rip, A. (2006b). *Technological Affordances and Constraints, Material Narratives and Socio-Technical Governance*. Paper presented at the Paper presented at the Twente VII Workshop on Material Narratives of Technology in Society, October 19-21, 2006, Enschede.
- Rip, A. & Van Amerom, M. (2010). Emerging *De Facto* Agendas Surrounding Nanotechnology: Two Cases Full of Contingencies, Lock-outs, and Lock-ins. In M. Kaiser, M. Kurath, S. Maasen & C. Rehmann-Sutter (Eds.), *Governing Future Technologies - Nanotechnology and the Rise of an Assessment Regime*. Dordrecht: Springer.
- Salo, A. & Cuhls, K. (2003). Preface - Technology Foresight - Past and Future. *Journal of Forecasting*, 22.
- Schaeffer, G.J. (1998). *Fuell Cells for the Future - A Contribution to technology forecasting from a technology dynamics perspective*. Petten/Twente: Dissertation.
- Suurs, R. (2009). *Motors of Sustainable Innovation -Towards a theory on the dynamics of technological innovation systems*. PhD Thesis. Utrecht: University of Utrecht.
- Swanson, E.B. & Ramiller, N.C. (1997). The Organizing Vision in Information Systems Innovation. *Organization Science*, 8(5), 458-474.
- Truffer, B., Voss, J.-P. & Konrad, K. (2008). Mapping expectations for system transformations: Lessons from Sustainability Foresight in German utility sectors. *Technological Forecasting and Social Change*, 75(9), 1360-1372.
- Van 't Klooster, S. & Van Asselt, M. (2006). Practising the scenario-axes technique. *Futures*, 38, 15-30.
- van der Meulen, B. (1999). The impact of foresight on environmental science and technology policy in the Netherlands. *Futures*, 31(1), 7-23.
- van der Meulen, B., de Wilt, J. & Rutten, H. (2003). Developing futures for agriculture in the Netherlands: a systematic exploration of the strategic value of foresight. *Journal of Forecasting*, 22(2-3), 219-233.
- van Lente, H. (1993). *Promising Technology*. Enschede.
- van Lente, H., Rip, A., Disco, C. & Van der Meulen, B. (1998). Expectations in Technological Developments: An Example of Prospective Structures to be Filled in by Agency *Getting new technologies together: studies in making sociotechnical order* (pp. 203-230). Berlin.
- van Merkerk, R.O. & Robinson, D.K.R. (2006). Characterising the emergence of a technological field: expectations, agendas and networks in Lab on a chip technologies. *Technology Analysis & Strategic Management*, 18(3/4).